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ABSTRACT

This symposium examined issues in the planning, development, and implementation of library automation and the effects of electronic publishing. The following presentations are included in this collection: (1) "Will There Be Electronic Anarchy?" (Helen Henderson); (2) "Ergonomics in the Electronic Era" (Andrew Torok); (3) "LS/2000--Synopsis of an Illustrated Talk Describing the OCLC Local Library System--LS/2000" (Niall Perry); (4) "The Online Catalog Revolution" (Frederick Kilgour); (5) "The Graceful Integration of Text and Facsimile in an Electronic Document Delivery System" (Thomas Hickey); (6) "Delivery Systems: Beyond Access" (Susan Martin); (7) "Electronic Publishing: Some Observations Evolving from Our Experience" (Oldrich Stander); (8) "Recent Work of the IEPRC (International Electronic Publishing Research Centre)" (Hans Ehlers); (9) "Electronic Publishing and Records Management" (Marc D'Alleyrand); and (10) "The Electronic Era: Implications for Consultancies" (Esther Dyer and Scott Bowker). The papers are supplemented by various figures, and most have bibliographic references or bibliographies. Two additional papers were presented: "New Developments in Electronic Publishing" (Alan Singleton), and "The Age of Information: The Development in Information and Communication on the Basis of New Technologies" (Wolfgang Anders). (EW)

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New Trends in Electronic Publishing and Electronic Libraries

Edited by

Ahmed H. Helal
Joachim W. Weiss

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Edited by

Ahmed H. Helal
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→ **Local Library Systems**

24 September - 27 September 1984

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Essen University Library

New Trends in Electronic Publishing and Electronic Libraries

Essen Symposium
29 August – 31 August 1983

Contributors

Wolfhart Anders · Marc D'Alleyrand
Esther Dyer · Hans Ehlers · Helen Henderson
Thomas Hickey · Frederick Kilgour
Susan Martin · Niall Perry · Oldrich Standera
Andrew Torok

Edited by

Ahmed H. Helal
Joachim W. Weiss

Gesamthochschulbibliothek Essen

Essen 1984

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presentation of their manuscripts.

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Essen Symposium 1983
Essen University Library
**New Trends in Electronic Publishing and
Electronic Libraries**

Essen, August 29 – August 31, 1983

Preface

As part of its continuing interest in evaluating new technological developments the Essen University Library arranged its 6th Symposium on library automation under the topic "New Trends in Electronic Publishing and Electronic Libraries".

The Symposium is an annual meeting, taking place in autumn, with a limited number of participants up to 80 persons.

This year's meeting was held from 29th August to 31st August 1983, immediately after the IFLA Conference in Munich, gathering 78 participants from 13 nations.

Once again the Essen Symposium tried to stimulate the inspiration of librarians and library managements in the field of planning, development, and implementation of library automation.

The items discussed ranged from economics of document delivery, new technologies, costs and advantages, electronic journal publishing, publishers and libraries, heavily used material (= rich database) and not heavily used material (= poor database = main body of research material), to the impact of electronic publishing on authors, publishers, booksellers, library-intermediaries, endusers, complete online libraries, online catalogues, etc.

In the late 1970s librarians suddenly recognized the importance of online catalogues. Advanced computers can handle massive bibliographic records and direct user inquiries (cataloguing and circulation); an online access is much more adequate than a card and COM catalogue. However, it must be simple with a very fast response time (less than 5 seconds). Computers in libraries are very expensive if they are only used to replace the manual catalogue products.

Electronic publishing is not only the process of printing. It should also cover the input, dissemination, and output of information via computers. No librarian is sure whether this will only cover primary or also secondary sources. However, videodisc storage with its massive storage can be sufficient and satisfactory.

As far as electronic publishing is concerned it is important to distinguish between parallel publishing and fully (only) electronic publishing. A combination seems to dominate the market. Concerning the publisher there can be centralized and/or decentralized systems of publishing.

Many of the leading scientific publishers are working on projects which are now under review. The Elsevier Science Publishers are cooperating with bibliographic retrieval services in order to study the full-text online journal publishing. The

American Chemical Society is offering 18 journal titles in full-text online. A joint development agreement between OCLC and IAC, a division of Ziff-Davis Publishing Company, to establish an overnight electronic document delivery is already launched. ADONIS (Article Delivery over Network Information Systems) was set up to tackle the copyright problem, i. e. to supply articles in interlibrary loans in a photocopy form and recording all transactions that copyright holders can get their fees or royalties. However, the ADONIS troubles are very serious; three of six publishers supporting the project have withdrawn.

In general, too many studies on electronic document delivery and the necessary technology exist today. The online availability of the full-text of journals, newspapers, textbooks and encyclopedias is growing very rapidly. The introduction of electronic publishing will be gradual and parallel with existing conventional methods.

During the current discussion all participants were pro electronic publishing which has to follow a carefully planned strategy, i. e. the online system will be an adjunct to the printed journals. The future will prove that online delivery systems are more economical than the printed version; publishers will use nontraditional means to distribute their publications following the least expensive method.

The Essen Symposium 1983 showed that we are not far from implementing an electronic library and electronic publishing. Essential elements are already known and operational or under development; the wide distribution of network systems, advanced developments in telecommunications, availability of all kinds of machine readable files (national bibliographies and resultants of cooperative cataloguing systems) and the development of very powerful and cheap electronic devices are remarkable advancements. One should also mention the international tendency for standardization and development of software packages for online communications with the computer and with any database the user wishes to deal with.

The age of electronic libraries and electronic publishing will speed up the integrated interaction among authors, publishers, users, and librarians who may act as intermediaries. The "Shelfless Academic Library" is going to be an active switching centre for information and acts just as a channel for document delivery requests. We may have two kinds of librarians: one group exclusively dealing with printed material and the other concerned with electronic media in an electronic library. However, there will be a period of transition and both types of librarians will cooperate.

In conclusion the items treated were highly pragmatic and covering a variety of methods and approaches based largely on the experience of speakers and participants.

Let us face the year 2000 courageously; it is only a matter of time that the electronic society replaces the paper society, i. e. the packaging and tailoring of electronic information is getting transparent. It is time for marketing and advertising.

Essen Symposium 1983
Essen University Library
**New Trends in Electronic Publishing and
Electronic Libraries**

Essen, August 29 - August 31, 1983

Agenda

MONDAY, AUGUST 29

- | | |
|-------|-------------------------------------|
| 9.30 | Registration |
| 10.15 | On-line-presentations |
| <hr/> | |
| 13.45 | Opening of symposium
A. H. HELAL |

Chairman: R. DE GENNARO

- | | |
|-------|---|
| 14.00 | Will there be Electronic Anarchy?
The Problems of Managing the Variety of Electronic and
Conventional Sources of Information in a Library
H. HENDERSON |
| <hr/> | |
| 15.30 | Ergonomics in an Electronic Society:
the Effects of Technological Innovation on People
A. TOROK |
| 16.15 | Discussion |
| 16.45 | On-line presentations |
| 19.00 | Reception |

TUESDAY, AUGUST 30

Chairman: B. ADAMS

- | | |
|------|---|
| 9.30 | OCLC Local Library System LS/2000
N. PERRY |
|------|---|
-

11.00 The Online Catalog Revolution
F. KILGOUR

11.45 Discussion

Chairman: R. FRITZ

14.00 The Graceful Integration of Text and Facsimile in an
Electronic Document Delivery System
T. HICKEY

15.30 Evolution of Document Delivery
S. MARTIN

16.15 Discussion

16.45 On-line presentations

19.30 Reception

WEDNESDAY, AUGUST 31

Chairman: M. HEIN

9.30 Electronic Publishing: Some Observations
Evolving from our Experience
O. STANDERA

11.00 Recent Work of the IEPRC
(International Implications for Consultancies)
H. EHLERS

11.45 Lunch

Chairman: D. RAITT

14.00 New Developments in Electronic Publishing
A. SINGLETON

15.30 The Age of Information: the Development in Information
and Communication on the Basis of New Technologies
W. ANDERS

16.15 Discussion

16.45 On-line presentations

Essen Symposium 1983
Essen University Library

**New Trends in Electronic Publishing and
Electronic Libraries**

Essen, August 29 – August 31, 1983

Participants

BELGIUM

Egghe, Leo

L. U. C., Universitaire Campus,
B-3610 Diepenbeek
Tel.: 00 32 / 11 22 99 61-2 24

CANADA

Standera, Oldrich

University of Calgary, Library,
Calgary, Alberta T2N 1N4
Tel.: 0 01 / 40 32 84-59 56

DENMARK

Barnholdt, Bent

Danmarks Tekniske Bibliotek,
Anker Engelundsvej 1, DK-2800 Lyngby
Tel.: 00 45 / 2 88 30 88-49 33

Hein, Morten

State Inspection of Public Libraries,
Amaliegade 13 B,
DK-1256 Copenhagen
Tel.: 00 45 / 113 46 33-2 40

Rishoej, Joergen

Bibliotekscentralen, Telegrafvej 5,
DK-2750 Ballerup
Tel.: 00 45 / 2 97 55 55-2 16

EGYPT

El-Assal, Magy Fahmy

Central Library,
Alexandria University, Alexandria

El-Bialy, Faiza Ali Hazan

Alexandria University, Alexandria

Chaker, Marie-Therese

Central Library,
Alexandria University, Alexandria

Gamal, Soheir Ahmed

Faculty of Agriculture,
Alexandria University, Alexandria

Morsy, Azhar Mohamed

Faculty of Medicine,
Alexandria University, Alexandria

Abd El-Nabi, Hekmat Mohamed

Faculty of Education,
Alexandria University, Alexandria

Nasser, Effat El-Husseuni

Central Library,
Alexandria University, Alexandria

Raphael, Hoda Mahrous

Central Library,
Alexandria University, Alexandria

GERMANY (FRG)

- Adams, Bernhard** Universitätsbibliothek Bochum,
Postfach 10 21 48, D-4630 Bochum
Tel.: 02 34 / 7 00 23 50
- Anders, Wolfhart** Universität Essen, AVMZ,
D-4300 Essen 1
Tel.: 02 01 / 1 83 34 36 / 38
- Burckhardt, Hans** Bergbau Forschung GmbH, Bücherei,
Postfach 13 01 40, D-4300 Essen 13
Tel.: 02 01 / 1 05 94 59
- Delbrück, Beate** Universitätsbibliothek Essen,
Postfach 10 14 54, D-4300 Essen 1
Tel.: 02 01 / 1 83 36 99
- Dokter, Gunter** Universitätsbibliothek Bochum,
Postfach 10 21 48, D-4630 Bochum
Tel.: 02 34 / 7 00 22 58
- Eberwein, Rosemarie** Universitätsbibliothek Konstanz,
Postfach 55 60, D-7750 Konstanz 1
Tel.: 0 75 31 / 88 28 00
- Ehlers, Hans** Ernst Klett Verlag,
Postfach 809, D-7000 Stuttgart 1
Tel.: 07 11 / 66 72-2 03
- Felsch, Hartmut** Universität Bielefeld, (Hochschulrechenzentrum) HRZ,
Postfach 86 40, D-4800 Bielefeld
Tel.: 05 21 / 1 06 49 51
- Franzmeier, Günter** Staatsbibliothek Preußischer Kulturbesitz,
Postfach 14 07, D-1000 Berlin 30
Tel.: 0 30 / 2 66 24 78
- Frenzel, Jörg** Chemische Werke Hüls AG, Wiss. Bibliothek,
D-4370 Marl
Tel.: 0 23 65 / 49 20 75
- Fritz, Rolf** DIMDI,
Postfach 42 05 80, D-5000 Köln 41
Tel.: 02 21 / 47 24-2 11
- Gewecke, Wolfgang** Gesellschaft für Information und Dokumentation (GID),
Sektion für Systementwicklung,
Tiergartenstraße 17, D-6900 Heidelberg
Tel.: 0 62 21 / 4 60 81
- Habermann, Heinz** DBI,
Bundesallee 184/185, D-1000 Berlin 31
Tel.: 0 30 / 8 50 51 31
- Halbe, Heinz-Georg** Universitätsbibliothek Bochum,
Postfach 10 21 48, D-4630 Bochum
Tel.: 02 34 / 7 00 22 58

- | | |
|--------------------|---|
| Hammerl, Andrea | Deutscher Bundestag (Verwaltung), Bundeshaus,
D-5300 Bonn 1
Tel.: 02 28 / 16 75 49 |
| Hastedt, Pedro | Universitätsbibliothek Essen,
Postfach 10 14 54, D-4300 Essen 1
Tel.: 02 01 / 1 83 36 99 |
| Helal, Ahmed Helmi | Universitätsbibliothek Essen,
Postfach 10 14 54, D-4300 Essen 1
Tel.: 02 01 / 1 83 36 99 |
| Hopping, Ann | USIS Bonn, American Embassy,
Deichmanns Aue 29, D-5300 Bonn 2
Tel.: 02 28 / 3 39 23 39 |
| Jüngling, Helmut | Bibliothek der RWTH Aachen,
Templergraben 61, D-5100 Aachen
Tel.: 02 41 / 80 44 50 |
| Kühnapfel, Petra | Universitätsbibliothek Essen,
Postfach 10 14 54, D-4300 Essen 1
Tel.: 02 01 / 1 83 36 99 |
| Lakatsch, Heide | Universitätsbibliothek Essen,
Postfach 10 14 54, D-4300 Essen 1
Tel.: 02 01 / 1 83 36 99 |
| Lingenberg, Walter | Staatsbibliothek Preußischer Kulturbesitz,
Postfach 14 07, D-1000 Berlin 30
Tel.: 0 30 / 2 66 23 50 |
| Mackay, Renate | Stadtbibliothek Duisburg,
Düsseldorfer Straße 5-7, D-4100 Duisburg
Tel.: 02 03 / 2 83 30 60 |
| Naroska, Marianne | Universitätsbibliothek Essen,
Postfach 10 14 54, D-4300 Essen 1
Tel.: 02 01 / 1 83 36 99 |
| Ortner, Doris | Universitätsbibliothek Essen,
Postfach 10 14 54, D-4300 Essen 1
Tel.: 02 01 / 1 83 36 99 |
| Rau, Peter | Hochschulbibliothekszentrum NW,
Postfach 41 04 80, D-5000 Köln 41
Tel.: 02 21 / 40 10 95 |
| Rhee, Waltraut | Gesellschaft für Information
und Dokumentation (GiD), IZ-Bibliothek,
Postfach 71 03 70, D-6000 Frankfurt 71
Tel.: 06 11 / 6 68 73 60 |
| Ruprecht, Christel | Staats- und Universitätsbibliothek Hamburg,
Von-Melle-Park 3, D-2000 Hamburg 13
Tel.: 0 40 / 41 23-58 17 |

- Rutz, Reinhard DFG,
Kennedyallee 40, D-5300 Bonn 2
Tel.: 02 28 / 8 85 24 18
- Schmitz, Bettina Dr. Karl Thomae GmbH, Wiss. Bibliothek,
D-7950 Biberach
Tel.: 0 73 51 / 54 23 88
- Schwalbe, Ingeborg Universitätsbibliothek Düsseldorf,
Universitätsstraße, D-4000 Düsseldorf 1
Tel.: 02 11 / 3 11 35 25
- Skibbe, Martin Hochschule der Bundeswehr,
Holstenhofweg 85, D-2000 Hamburg 70
Tel.: 0 40 / 65 41 27 13
- Sterzenbach, Heike Universitätsbibliothek Essen,
Postfach 10 14 54, D-4300 Essen 1
Tel.: 02 01 / 1 83 36 99
- Stille, Marion Universitätsbibliothek Essen,
Postfach 10 14 54, D-4300 Essen 1
Tel.: 02 01 / 1 83 36 99
- Tigler, Aurelia USIS Bonn, American Embassy,
Deichmanns Aue 29, D-5300 Bonn 2
Tel.: 02 28 / 3 39 28 23
- Umstätter, Walther FHBD-Köln,
Universitätsstraße 33, D-5000 Köln 41
Tel.: 02 21 / 4 70 52 08
- Weiß, Joachim Universitätsbibliothek Essen,
Postfach 10 14 54, D-4300 Essen 1
Tel.: 02 01 / 1 83 36 99
- Williams, Robert ISI GmbH,
Stadthof 9, D-6050 Offenbach
Tel.: 06 11 / 88 90 77

GERMANY (GDR)

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Postfach 47, DDR-9200 Freiberg

IRAQ

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P. O. Box 101, 5900 MA Venlo
Tel.: 00 31 / 7 79 22 22-21 50
- Nouwen, Johannes Swets Subscription Service,
P. O. Box 830, 2160 SZ Lisse
Tel.: 00 31 / 2 52 11 91 13
- Peperkamp, Hendrik Duphar B. V.,
P. O. Box 2, 1380 AA Weesp
Tel.: 00 31 / 29 40-7 11 10
- Raitt, David The Electronic Library,
Frankenslag 179, 2582 HL Den Haag
Tel.: 00 31 / 17 19-8 30 17
- Schoots, Piet City Library,
Hoogstraat 110, 3011 HP Rotterdam
Tel.: 00 31 / 10 33 82 44

NORWAY

- Thalberg, Knut Universitetsbiblioteket NTH,
Høgskoleringen 1, N-7034 Trondheim
Tel.: 00 47 / 7 59 51 01

POLAND

- Pindlowa, Wanda University Library,
Al. Mickiewicza 22, 30-059 Krakow

UNITED KINGDOM

- Bivins Noerr, Kate Information Management & Engineering Ltd.,
57 Eden St., Kingston on Thames KT 1 1DA
Tel.: 00 44 / 15 46 79 68
- Buckle, David OCLC Europe,
75 Edmund St., Birmingham B3 3HA
Tel.: 00 44 / 2 12 36 32 24
- Ferguson, John Chadwyck-Healey Ltd.,
20 Newmarket Rd., Cambridge CB5 8DT
Tel.: 00 44 / 2 23 31 14 79

- Henderson, Helen Information Management & Engineering Ltd.,
57 Eden St., Kingston on Thames KT 1 1DA
Tel.: 00 44 / 15 46 79 68
- Leamy, Charles Office of Arts and Library,
39 St. Catherwick, Newton Grove London W4
Tel.: 00 44 / 19 28 32 50
- Noerr, Peter Information Management & Engineering Ltd.,
57 Eden St., Kingston on Thames KT 1 1DA
Tel.: 00 44 / 19 79 71 05
- Perry, Niall OCLC Europe,
75 Edmund St., Birmingham B3 3HA
Tel.: 00 44 / 2 12 36 32 24
- Singleton, Alan F. W. Faxon Company,
44, Blandford Rd., St. Albans,
Herts., AL1 4JR
Tel.: 00 44 / 72 76 27 61

U. S. A.

- De Gennaro, Richard University of Pennsylvania,
Van Pelt Library, Philadelphia PA 19104
Tel.: 0 01 / 215 898 70 91
- Hickey, Thomas OCLC,
6565 Frantz Road, Dublin, Ohio 43017
Tel.: 0 01 / 614 764 60 55
- Kilgour, Eleanor
Kilgour, Frederick OCLC,
6565 Frantz Road, Dublin, Ohio 43017
Tel.: 0 01 / 614 764 60 50
- Martin, Susan John Hopkins University,
Eisenhower Libr., Baltimore, Maryland 21218
Tel.: 0 01 / 30 13 38 83 25
- Snead, Barbara Hiram College Library,
Hiram, Ohio 44234
Tel.: 0 01 / 216 569 53 53
- Torok, Andrew Northern Illinois University,
Dept. of Library Science,
DeKalb, IL 60115
Tel.: 0 01 / 815 753 17 33

SWITZERLAND

- Gebhard, Rene Ciba-Geigy AG, R-1046.3.19,
ZWM/Library Section,
CH-4002 Basel
Tel.: 00 41 / 61 37 20 36

Will there be electronic anarchy?

Helen Henderson
Information Management & Engineering Ltd.
Kingston on Thames
Great Britain

Introduction

Users of information already have to suffer a wide variety of manual and electronic media and products, and are becoming increasingly worried about the anarchy being created by the constant changes in the technology. It is now difficult not only to identify a system containing required information, but to actually retrieve the information from the system. Storage and maintenance is becoming even more expensive because of the proliferation of media and thus necessary duplication. We still don't need expensive equipment to read paper documents, but with the multiplying electronic media the average library or information unit is looking like a manufacturers' showroom or possibly mausoleum.

By comparing and contrasting some of the attributes of conventional and electronic publishing it may be possible to identify potential problems and thus be prepared for anarchy.

Comparison of features

Standards

These are now taken for granted in conventional publishing, but have taken centuries to establish. There are still many different standards for the printed page (except for some parts of Scandinavia where books are rebound to a standard size). The problem of standardisation in electronic publishing was highlighted by the recent BLEND project, where the sheer number of different formats of floppy discs for data input caused major problems. It is interesting to note that there are very few international standards in publishing. One of the few examples is in music, which can be understood worldwide and therefore played by most musicians.

Ease of Use and User Acceptance

Apart from the problems of foreign languages and literacy, most conventional publications are extremely easy to use. Mechanised media from microfilm upwards are not only awkward (i.e. not natively readable) but often offputting to the user. It is often thought that, as with microfilm again, the user will become used to the media but this has not happened in the majority of cases. The information also has to be formatted in an entirely different way, because the scanning and searching process is difficult and entirely different.

Control

Bibliographic control has taken a long time to develop and even now is not satisfactory. To make the best use of the electronic media it will be necessary to impose some form of control very soon. The CEC is making a start in this by looking at ways to relate bibliographic references to the full text of electronic documents.

Production

With conventional publishing, very different technologies produce a similar result. With electronic publishing this is certainly not the case.

Economics

With electronic publishing it suddenly becomes very easy to quantify usage of documents. This can be both an advantage and disadvantage, in that low use documents can be identified and budgeting made easier by printing-on-demand. However it

sometimes makes the justification of purchase of certain types of document more difficult.

Access Restrictions

The problems of transborder dataflow have been exacerbated by electronically generated information, and although there are many political restrictions on printed products (vide the present UK embargo of Argentinian books) they are not as politically obvious as the access problems of electronic services.

Stability

There are considerable problems of stability of the media. With the different, sometimes manufacturer dependent, standards, it may not be possible to even access information in ten years time because the particular manufacturer has gone out of business and cannot maintain or replace the equipment used to access the information.

Timeliness

The one great new advantage of the electronic media is the quick access to material. Until recently, if information was published it was therefore almost invariably out-of-date, the only problem is defining when information is actually published. Is it once it has been input to a system, or even when it has been accessed by a user?

Without decrying the many advantages of the electronic media, it should be emphasized that unless both librarians and publishers are able to overcome these problems the electronic media will only add to conventional media without replacing it, and create a

second level of chaos. To take the present level of communications and applications in the United Kingdom as an example the proliferation of incompatible media is obvious.

Communications

Public Network:

PSTN (Circuit Switched Telephone Network)
 PSS (Packet Switched Network)
 ISDN (Integrated Services Data Network)
 Satestream (Satellite Network)
 Megastream (64 kb private leased)
 Mercury (private optic fibre voice and data)
 Cable TV

Local Network

Cambridge Ring (local area network with bits and packets)
 Ethernet (local area)
 Wide Band (high data rate transfer, voice, confer)

Applications

Public

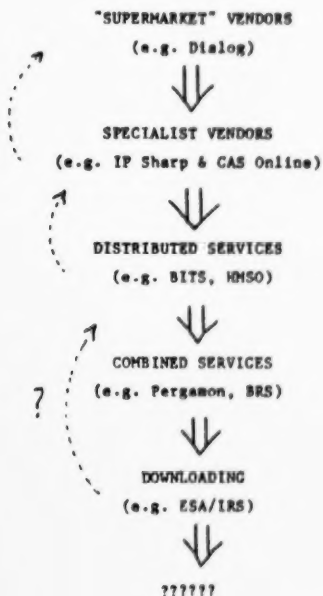
Teletex (terminal to terminal)
 Prestel (videotex)
 Datafax (high speed graphics)
 Telecom Gold (CBMS, databases)

Private

Private viewdata
 Store and forward fax
 BLEND

With the wide variety of communications media alone, it is becoming easier in some ways to communicate only within a discreet group, this in turn may promote more "grey literature" and raise problems with the identification of material.

Online Services



In looking at how online services have evolved it can be seen how easy it is for anarchy to develop. The so-called "supermarket" services recognised the market for a high volume of usage on one

system, and by the easy use of multiple databases. Contemporaneously the specialist vendors of user specific services like IP Sharp, Geisico and ADP started by selling processing time, but recognised the need of databases to support these processing services and have started to either buy in databases or even to create them specially.

The other new type of specialist vendor also tries to be user specific, for example CAS Online. In addition to its own databases it is acquiring exclusive rights to databases that are of interest to its own customers, attempting to make the users dependent on one vendor. Vendors are also selling subsets of their databases packaged for specific requirements, Biosis (BITS) and HMSO are two recent examples. Because of the ease of downloading it has become necessary for vendors to allow the users to create their own databases, usually consisting of a mixture of internal and external (or public and private) data.

Maybe we should look at what is going to be the next stage of the evolution. With the same piece or type of data now available from at least three different sources, who will benefit? Maybe the growth industry is selling incompatible software for the creation of private databases or swapping access to each other's databases.

Anarchy

Having worried about all this anarchy in electronic publishing, a comparison was made with a typical office environment. This was not encouraging in that there seemed to be even more incompatibility. An example is the following listing from one of our client's offices:

The current "technology" includes:

- Typewriters (4 different typefaces)
- Telex (2 machines not communicating)
- Photocopiers (2 different types)
- Telephones (1 internal system, 1 external)
- Word processors (3 different networks)
- Facsimile
- Microcomputers (3 different stand alone systems)
- Terminals (3 different makes)
- Modems (3 different types)
- Videotex (internal & external viewdata, teletext)
- CBBS (2 public, 1 private)
- Videotapes (3 different systems)
- Laser printer (only 1 at the moment)
- Digitiser

Current planning for this office includes:

- Optical discs
- Videodiscs
- Teletex
- Voice mail

The only thing that is missing is an electronic waste-paper basket (only because they do not have an Apple Lisa microcomputer).

Solutions

To solve some of these problems there appear to be three types of solution:

Information brokers

By using information brokers for electronic systems in a similar way to subscription agents for paper publications, the end user may benefit. There should be no need for dozens of passwords, invoices, currencies and operating systems. Maybe this is the future role for the information unit or library, as an information broking centre that has to actively market their services?

Multi-media information processor

This could be either hardware or software acting as either a concentrator or switching agent. A small local area or wide band network could allow access to any of the multi-media systems, possibly using one terminal or access point. This solution would tend to be a centralised system with multiple access.

User-friendly devices

A comparatively simple solution is the "user-friendly" terminal. This could allow access to both remote and local systems, and could also be programmed for a specific end-user. By moving the emphasis to the user, considerably more flexibility is allowed in the means of access, although the accounting system problems still occur. In the short term, this seems the most feasible solution.

Conclusion

One problem that still remains is in whose interest is it to prevent anarchy? Certainly not the manufacturers, whose sole interest is in selling the maximum amount of hardware and

software. The publishers would like to be able to sell both electronic and printed products, because it is unlikely the printed product will ever die. The currently harassed intermediaries would be unemployed if it became too easy for the end users to access all these systems themselves. The end users do not worry where the information comes from, and their greatest source is word of mouth anyway.

Is this heresy? As a consultant there are also vested interests, all this anarchy is one of the reasons that consultants can make a living. It looks as if, even in the future, consultants will be needed to sort out people's compatibility problems.

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Ergonomics in the electronic era

Andrew Torok
Department of Library Science
Northern Illinois University
DeKalb, Illinois
U.S.A.

ERGONOMICS IN THE ELECTRONIC ERA

History and General Overview

The purpose of this paper is to briefly discuss humanistic elements affecting man-machine relations, particularly as they pertain to the design and use of computers.

The term "ergonomics" has become popular with the American media and authors in describing the effects of computerization on work productivity, job satisfaction, safety, and so on. Most of the articles of late have dealt with office automation, radiation hazards of visual display terminals (VDT), and acceptance of computerized systems by end users. This is an interesting shift from earlier articles which dealt more with fear of technological innovations by professionals such as office workers, librarians, and others.

The term "ergonomics" or the concepts and disciplines it represents are not new. The term originated in 1949 when a group of researchers felt that a society was needed to bring together members of diverse disciplines who shared a common interest in human performance. The group chose "ergonomics" from the Greek words "ergon" meaning work, and "nomos" meaning natural laws. It was a simple word which could be translated into other languages and which did not imply that any one discipline was of more importance than

another. Membership consisted of anatomists, physiologists, psychologists, doctors, hygienists, design and production engineers, architects, and others. The Ergonomics Research Society of Great Britain thus formed one of the first groups which represented the new interdisciplinary field of ergonomics. Since that time most countries and disciplines have formed associations concerned with the interaction of people and machines, such as The Human Factors Society, The Society of Engineering Psychologists, and the Gesellschaft für Arbeitswissenschaft. Ergonomics is then formally defined as "The scientific study of the efficiency of man in his working environment."

The term caught on rapidly in many parts of the world except in the United States, and perhaps Russia. The U.S. continues to use the terms "Human Factors Engineering" or "Human Engineering" while in Russia the term "Engineering Psychology" is still preferred. There is some disagreement whether the terms are synonymous, depending on an individual's viewpoint. From the engineering viewpoint, there is concern for designing machines which are compatible with human characteristics, such as proper positioning of dials. One reason for the Three Mile Island nuclear plant crisis was that the distance between instrument dials and the plant's controls was too great for an operator to correct malfunctions. "System Design" or "Systems Engineering" is more descriptive of the engineering professions.

Engineering psychology is more concerned with with how people use machines and how machines alter behavior. Examples include physical and mental stress, societal change, and group versus individual behaviour. Engineering psychology grew out of experimental psychology whereas systems engineering is more closely related to industrial engineering. Still other fields, such as from the health sciences, are more concerned with physiological aspects of human functioning in work environments. Thus ergonomics can be considered a discipline in its own right or as a sub-field of another discipline. The field of ergonomics has in turn developed its own sub-fields. For example computer ergonomics, office ergonomics, and so on.

The concepts behind ergonomics did not begin in 1949. A translation of Hammurabi's code of laws from 2200 BC states that if a builder builds a house which collapses and causes the death of the owner, then the builder shall be put to death; or if the house collapses and causes the death of a son of the owner, then a son of the builder shall be put to death. These laws should be required reading for today's systems engineers.

More recent accounts of human factors studies trace back to the turn of the present century with the work of Frederick Taylor who made empirical studies to discover the best design of shovels. Unfortunately, the shovel remains one of the most poorly designed tools from an ergonomic

standpoint since Taylor's studies were more concerned with productivity and worker motivation than with worker comfort.

Around 1940, Frank Gilbreth experimented with a variety of human-factors designs, such as the optimal height of scaffolding for bricklaying. His findings in this area resulted in increasing productivity three-fold. Taylor and Gilbreth's studies formed the basis of a branch of industrial engineering known as time-and-motion studies.

GENERAL AREAS AND TOPICS FOR ERGONOMIC RESEARCH

Probably the greatest stimuli for ergonomic studies have been problems encountered during WWII and to some extent WWI. In analyzing data from WWI it was found that 93 out of 100 plane crashes were due to pilot error. However it was not until WWII that serious concern was shown for the inability of people to use machines as they were intended. Whales were depth-charged, friendly ships were sunk, bombs missed targets, people fell asleep at controls after only a short time, and so on. Research programs were undertaken to analyze the data and carry out further research. It was from such research groups that the British Ergonomics Society was formed. One of the major problems was determining whether errors were design-related or due to human error. Design error involved problems with components malfunctioning, control functions and locations difficult to determine, and so on. Human error involved memory loss, low aptitude, effects of stress, boredom, etc.

Ergonomics research has continued to prosper since that time, although the groups appear to have split into distinct disciplinary boundaries in terms of research objectives. The first priority of engineers is in building machines that work. The component engineer is responsible for the functioning of a part or a group of parts, such as what type of chip to use in a computer, maintenance features, placement of dials, etc. The systems engineer is responsible for understanding how the components will work together and how they will be used. The systems engineer is responsible for understanding how small problems acting together cause overall loss of efficiency, such as in response time, or heat production.

If the focus of engineers is on basic design and functioning, then psychologists are concerned with the effect of the machines on human behavior. In the robotics field, engineers are concerned with building robots which will work better or be more cost-effective than alternate modes such as people. Psychologists are concerned with the effect of robotics in labor relations, job security, technologically-induced fear, and so on.

It is fair to say that ergonomic studies remain divided along disciplinary boundaries. Furthermore, a brief examination of citation patterns indicates that they do not make such use of each other's findings. Thus articles dealing with human factors grow steadily but appear to

remain within the literature of each group despite similarity in subject matter, such as health hazards of VDTs.

The subject matter for research has remained fairly predictable. Many of the research problems being investigated are a result of problems encountered in the use of machines, or are of such magnitude that they clearly furnish motivation for research. Magnitude can include the critical nature of the problem, such as death or disability, sheer numbers of people involved, or the importance of the man-machine mission, such as winning the war, or business survival.

As a current example, 45% of all inspections by the Occupational Safety and Health Administration (OSHA) are made in the construction industry, even though construction employs only 6% of the work force. This is due to the critical nature of the accidents. Thus there has been a steady growth of ergonomic literature dealing with construction site accidents.

PHASES IN MAN-MACHINE RELATIONS

Ergonomic concerns have grown proportionately with man's increasing involvement with machines and the growing complexity of machines.

This involvement has been described as going through different phases. The first phase began with the industrial

revolution in the mid 18th century and carried through until the 1870s. This was an age of tools more than machines since each machine was generally designed to carry out a single function which did not affect or rely on other machines. These early machines were characterized as being primarily operator-directed, meaning a great amount of physical labor was needed. The second phase was often termed the power phase, and extended until approximately 1945. Machines had become more developed and provided more of their own power. Man merely worked the controls. Furthermore, machines had become more specialized in terms of relying on the functioning of other components in a system. The third phase has been termed the mind phase. People merely monitor machines. Machines turn themselves on and off and carry out numerous internal operations without human intervention. This then was the dawn of the computer age.

THE ELECTRONIC ERA: Phase One

Although the first electronic computer had been successfully introduced, aeronomic researchers for a number of years continued to work on other more pressing problems identified during the war. The military accounted for a large portion of the funding available for this type of research and electronic computers did not represent a large enough problem area in terms of critical problems affecting

a significant portion of the population. Furthermore, many ergonomic researchers were not very familiar with computers. During the late 40s however, we did see the development of several different fields which contributed heavily to later ergonomics research. Cybernetics, systems analysis, operations research and other related areas were beginning to be applied to non-military settings.

The business community began to use computers in the mid-fifties but widespread use of computers did not occur until much later. The applications were somewhat limited and computer communications required specialized skills. Although keypunchers and data entry clerks were spending considerable time in front of machines the need for an ergonomic environment was still not well known. There was little interaction between data processing people and users of their products. It was not until computing power was available on a wider scale that one could truly discuss the electronic era.

The birth of the electronic era coincided with the arrival of the information age. During the late 60s and early 70s there was a growing realization that recorded information was necessary to function. Information was described as having power. Furthermore, there were many more people being involved in information work. More information was being produced than ever before. There was a need to access information quickly and to be able to

identify information sources which were bibliographic in nature. Accordingly, the first phase of the electronic age began in the early 70s with the widespread ability to deliver computing power into the work environment of large numbers of non-computer professionals. The development of interactive data processing, bibliographic retrieval using telecommunications, and the availability of user-friendly systems marked the beginning of the electronic era.

Bibliographic data bases became an important source of information. Access to data base services was made possible through powerful query languages which required little knowledge of computing principles.

It was therefore somewhat surprising that the new bibliographic systems were not as widely accepted as one might imagine. Even users with access to the equipment did not readily turn to searching bibliographic data bases. This then formed the basis for numerous ergonomic studies within the information science community. Few questions were answered although it was common knowledge that most users do not perceive the same need for information as people whose job it is to provide it. It was also known that most people prefer not to use the library as an information source, relying more on colleagues and other sources. Although the computerized information systems were not as ergonomically desirable as one might think the main reason for non-acceptance may have been that information

seeking tasks were not high priority enough to make the systems worth using. Managers require sophisticated flexible information systems, but are unwilling to spend the time and effort needed to learn to use a system or to specify questions in terms the system will accept.

These reasons may have contributed to the rise of a new information professional, the online searcher. It remains a question as to whether these intermediaries were successful. Consisting primarily of librarians, these professionals lacked both a knowledge of computing and in many cases a knowledge of the user's subject by virtue of their education and experience. However, libraries seemed to be the place for online search services since they enhanced the reference function and users relied on the library's collection for document backup.

The first electronic era also saw the development of more library-oriented systems, such as what are now known as "bibliographic utilities". With the success of these ventures, the automation work of the Library of Congress, and efforts of large libraries automation work quickly began. For example, online catalogs accessing library holdings became a potential reality.

THE ELECTRONIC ERA: Phase Two

Libraries began to work on developing machine-readable data bases and in marketing their online search services.

However not all libraries or individuals had access to computerized services since purchasing of equipment could not be rationalized in a cost-effective or cost-beneficial manner. Then in 1975 the introduction of another technological development had a dramatic impact on man-machine interaction . The electronic era reached a new phase with the introduction of computer systems using Very Large Scale Integrated (VLSI) circuits.

For the cost of what would have bought a good terminal individuals were able to purchase microcomputers which were adeptly suited to a myriad of tasks. Thus it was no longer necessary to purchase equipment which might be used only for bibliographic searching. Furthermore, the end user of information had greater flexibility in sequencing information. The increasing popularity of microcomputers spurred the development of additional information systems and the re-design of existing ones to suit the characteristics of an even more computer illiterate population.

It became important to determine how users preferred to use computers and what kind of information was desired.

PROBLEMS IN ERGONOMIC DESIGN

Hardware and software engineers began to take an interest in ergonomics in order to develop appropriate products. Ergonomic design in the broad sense refers to factors which affect system performance as well as

user-friendly features. This is generally true for both hardware and software development. Unfortunately, a number of conflicting situations often lead to less than optimal products. Some of these follow:

1. Technology changes too fast to provide reliable data on how people are affected by a particular system. Thus designers have difficulty in modifying products according to how they are used. Ergonomic features may be considered but become frozen in the design stage due to the need to go into production.

2. As people learn to use a system, they become more intolerant with its performance. Thus response time, display features, etc. may become inadequate. Designers often do not provide layered systems which take into consideration a user's knowledge.

3. In order to keep costs down, a basic design principle is to avoid "over-engineering". A product is over-engineered if it works the first time it is tried. In general, human-factors design considerations lead to over-engineering, thus cost overruns. This is a luxury manufacturers cannot afford with competition for the market.

4. Products are often not tested sufficiently. They are sometimes sold before production and often do not get beyond benchmark testing. Ergonomic data is virtually absent.

5. A related problem has to do with the size of the manufacturer. Many of them do not have the luxury of a human-factors group on the staff. Thus they do not even have ergonomics in the design stage. Not all companies can afford the luxury of ergonomic testing. For example Kodak ergonomists tried 63 different designs for the disc camera before marketing the most convenient.

HARDWARE, SOFTWARE, & TASK DEFINITION

The second phase in the electronic era saw several changes in hardware and software systems which directly affected users. During the first phase, the most complicated choice most users had to make was what type of terminal to buy. Selection and operation of computer systems within a given institution, particularly libraries, could be traced back to the efforts of strong-willed influential individuals. For the most part, the bulk of computer users merely learned to use what was provided for them.

Individual users had little need or opportunity to be concerned with selection of hardware and software since computers were still expensive enough to warrant a trained operations staff or the use of turnkey systems. With the advent of microcomputers users now had to become computer literate to the extent of becoming familiar with how a computer functioned, what type of software was needed, and

in general how to handle virtually all phases of computing. Manufacturers could no longer offer the hardware and software support built into the cost of large systems. Manufacturers of most microcomputer systems are not even in the software business but rely on independent software houses to provide for users' needs. 50% of the software houses that existed three years ago are no longer in business. Despite the relatively great advances in programming languages, it is still not feasible for the average individual to write sophisticated programs. The documentation provided by manufacturers was still written for the computer literate and much software written today lacks documentation. Users were forced to rely on the vendors from whom the hardware and software were purchased. Enough horror stories prevail to indicate that communications and contract problems alone were enough to discourage the user. Thus the literature of virtually every discipline is redundant with articles on how to buy hardware and software, how to select vendors, contract negotiations, and operating tips.

Perhaps the greatest change with the advent of microcomputing has been the need to redefine tasks which had been performed manually or through intermediaries on other larger computers. A number of human characteristics make this a difficult process, both for the user and the systems engineer attempting to develop hardware or software.

Research indicates that particularly with respect to technological change, people tend to resist unless they are also instrumental in the change. Normally people prefer to do things the way they first learned them. Managers often initiate change and operate under theories that no longer or never were valid. They may choose the computer system without having to use it or understand much about it, causing user frustration.

In designing systems, engineers have been criticized for ignoring human behavior. However they face the difficulty of not being familiar with many of the tasks users expect to perform. Furthermore, research has indicated that different tasks stimulate different kinds of information behavior even within the same individual. Thus human behavior and task analysis research provide conflicting data useful for design.

The economy of scale also acts on software design. In order to make the sale of software competitive, it must appeal to a broad enough segment of the market. Thus programs are written to accommodate a number of tasks, but perhaps do not reflect the way in which any given individual or institution operates. Thus users must redefine tasks within the constraints of the software and the hardware. This has led to the popularity of data base management programs and other multipurpose designs. Several current hardware systems have dual processors to accommodate different types of software and operating environments.

Computer ergonomics has evolved considerably over the past few years. Two sub-fields receiving particular attention are Cognitive ergonomics and software ergonomics. "Cognitive ergonomics" deals with the way in which humans behave with respect to occupation and the machinery used, and "Software ergonomics" deals with the psychological aspects of how software is produced and used.

SPECIFIC TOPICS FOR RESEARCH

In its formative years, computer ergonomics, particularly as applied in engineering psychology, has been concerned with the introduction of new technologies into the work environment. Early studies were concerned with user resistance, fear of technology and effects on the information-seeking behavior of users. These studies are still being conducted since as each new segment of the population becomes more closely involved with technology the basic problems remain the same. A recent study indicates that a third of all workers who deal with information are wary of the computer terminal rather than receptive to it.

Probably one of the most frequently investigated topics in the electronic era has been the effects, if any, of VDTs on people. A great deal is known about VDTs since they have been in use for several years. VDTs are essentially high quality television sets. They are not the product of new technology, thus testing procedures and safety features have

been in effect for some time. Early VDT studies were concerned with health hazards, particularly radiation leakage and eye and back strain. Ergonomic studies have indicated that many of the problems formerly associated with VDT use were really a result of poor work station design and other environmental factors.

Results of recent studies from the National Science Foundation the National Institute of Occupational Health and other major associations have all given VDTs a clean bill of health with regard to radiation leakage. However, VDTs can cause pink fringe, also known as the McCollough effect, and specific features of VDTs and print terminals do create discomfort.

Ergonomic features of VDTs that have received a great deal of attention include keyboard layout, angle and swivel of keyboard and screen, legibility, size and color of display, means of data input, static electricity, and time factors associated with use. As a result of these studies a number of improvements were made such as detachable keyboards, swivel terminals, recommendations for screen color, character size, room lighting, and so on. The general area of office automation has also been concerned with the use of VDTs and with appropriate furniture to suit the characteristics of a changing workforce and changing job functions. Optimal heights and design of office furniture are only two other environmental factors being studied.

A recent study found productivity gains of nearly 25% when VDT workers were placed in ergonomically correct work stations.

More important, but less often investigated is the mental strain that develops with the introduction of new machines. The testy nature of computer operators and programmers has long been treated jokingly, but never considered seriously by anyone who did not have to work with them. However, personality and productivity problems are likely to increase for a much larger portion of the population with the increase in the use of microcomputers since they are being placed in essentially similar environments. Symptoms include frustration, confusion, sensory loss, irritability and other undesirable mind states. A number of reasons may be causing these problems. Computers tend to be demanding and often become the master rather than the slave. We do things a certain way because the computer demands it. Tasks start to be performed at the will of the computer and we are often ill-prepared for disaster. Take for instance the head crash at RLIN (Research Libraries Information Center) headquarters which destroyed almost 20% of the bibliographic utility's data base which had not been backed up. Managers blamed the fault on too much pressure for rapid development of the system.

Quite often managers are not as directly involved with the routine computer operations as office workers. The pressure for increased productivity is placed on the workers without a real understanding of the problems by the managers. The effects of shift work have been studied extensively in the industrial sector but results have been seldom applied to computer operators who work non-traditional hours to gain better response time or cleaner lines.

As microcomputer use increases, mental strain and subsequent physical symptoms are likely to increase, creating the need for additional ergonomic studies.

Fortunately, systems are becoming easier to use, users are becoming more computer literate, software is becoming more flexible, and managers are becoming more aware of the need for ergonomic environments.

ERGONOMICS OF INFORMATION SYSTEMS

With increased use of computers by professionals who are not computer specialists and the demonstrated feasibility of home-delivery computerized information systems, the information science community has become involved in identifying user reactions to the new systems and attempting to enhance access to informatics by the non-specialist. Thus it has become fashionable to again examine the nature of query languages and other means of

communicating with computers in order to suit the characteristics of the users. Problems in man-machine dialogue are as old as the history of computing, although serious ergonomic studies trace back only to the development of the electronic era. It was only when the non-specialist began to use computers that concern was shown for the best way to communicate. Query languages for searching bibliographic files were of particular interest to librarians and information specialists since it was thought that they were too difficult to use. Natural language commands were not ideally suited to all individuals, thus research has led to the development of menu-driven systems, touch screens, and layered instruction sets that can be adjusted to the knowledge level of the user.

The growing use of microcomputers has also spurred the development of user-oriented programming languages and software packages that translate user queries into the query languages of various data base vendors. Downloading of information from main frame computers has become an accepted part of the communication process. Computer-to-computer communications and voice input are becoming commonplace.

Electronic publishing is another area which is receiving a great deal of attention today. Several different activities are often included in the term, ranging from computer-prepared newspapers to home document delivery

on terminals or floppy disks. Viewdata systems, optical disks, and new microcomputer-based large scale storage devices also come into discussion. Major technological and economic problems still remain. Perhaps even more important are the human problems. Wall Street Journal recently wrote "Electronic publishing will be the death of the copyright law." Will it be the death of the scientific journal and other media? How will the research community treat it with regard to information seeking? What affect will electronic publishing have on the functioning of libraries? Can the library still provide relatively inexpensive document backup?

With regard to electronic libraries, the development of online catalogs still seems to be the major goal for most libraries. Libraries are still experimenting with display formats, query languages and other ergonomic variables which have been studied for a number of years.

What success will the occasional user have with these systems? If home access is permitted to library catalogs, what security measures can be instituted? Will international linking of online catalogs become feasible. To what extent will the ability to personalize catalogs affect standardization, or will publishers take over catalog production and maintenance?

SUMMARY AND CONCLUSIONS

The purpose of this paper has been to focus attention on the human factors affecting our ability to harness the power of the computer. The unlimited capability of technology versus the limitations of human beings will continue to create numerous problems requiring ergonomic research. Engineers, information scientists, and concerned users will need to work together to develop predictive models which incorporate the subtle effects of technological change on traditional environments.

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LS/2000

Synopsis of an illustrated talk
describing the OCLC Local Library System

N i a l l P e r r y

Online Computer Library Center, Inc., Europe
Birmingham
Great Britain

1. History

OCLC has been developing a standalone, integrated library system for a number of years; the arrival of LS/2000 in the market place represents a significant acceleration of that development.

LS/2000 is essentially a version of the Integrated Library System which was designed by the National Library of Medicine in the late 1970's.

ILS, being in the public domain, was developed and marketed by two companies during the early 1980's; AVATAR Inc. and Online Computer System Inc. (the latter working in association with NLM). OCLC has since acquired all rights to the Online and AVATAR versions of ILS and is developing and marketing the system, in association with Online and AVATAR, under the product name LS/2000.

A testbed site known as the Dublin cluster is being installed at the moment for the OCLC Corporate Library in Dublin, Ohio along with the University of Massachusetts Library and the University of Akron Library.

The first commercial installations are due to go live in January 1984. These are the University of Newcastle in the UK and the 'Five Colleges', a clustered system, in the US.

2. Concept

LS/2000 is a mini-computer based, integrated library automation system designed to offer a comprehensive range of services to libraries in one 'total' product. The emphasis of the system

is on its integration and this can be illustrated to exist at a number of different levels

- I. The user, at a terminal, using LS/2000.
- II. The user, using LS/2000 via a Local Area Network, which provides multi-users access to the system.
- III. LS/2000 offering services to a 'cluster' of libraries allowing them to share resources, services and costs.
- IV. LS/2000 users having access to the OCLC Online Union Catalogue and the 'Shared' services based around it, i.e. Cataloguing, Acquisitions, ILL, Serials Control, Nameaddress Directory.
- V. Access via OCLC's forthcoming 'GATEWAY' service to a range of national and international databases and networks.

In simple terms, the concept allows the user access to all services listed above from the same terminal.

3. PHILOSOPHY

LS/2000 is designed to offer services to support a range of library operations; Public service, Technical services, and Administrative services.

- I. Public services will include Circulation control, ILL, Reference services via GATEWAY, and the Online Public catalogue.

- II. Technical services will include Acquisitions, Cataloguing and Serials Control.
- III. Administrative services will include operational control, financial control and profiling.

Returning to the central concept, LS/2000 is a 'total' system embracing all aspects of library operations and available to multi-users both on-site and remotely.

CLUSTERING

This facility, unique to LS/2000, allows libraries the option of sharing equipment, data, resources and costs.

There is great flexibility in the scope for data sharing e.g.

- I. Libraries may maintain separate, discrete and private bibliographic and patron files.
- II. Libraries may maintain separate files, while allowing each other a searching capability, but denying an editing capability.
- III. Libraries may maintain separate files and offer searching and editing capabilities to each library in the cluster.
- IV. Libraries may share bibliographic and/or patron files at the same time allowing reciprocal loan privileges throughout the 'cluster'.

4. EQUIPMENT

CPU

LS/2000 runs on a range of computer equipment

- I. The Data-General Eclipse range, from the S120 to the new MV10000, supporting 192 terminals.
- II. The DEC PDP range.
- III. The IBM Series 1.

OCLC has negotiated a worldwide OEM agreement with Data-General and will standardise and recommend DG equipment. The other ranges are available as options (e.g. where a library already has DEC or IBM equipment available).

TERMINALS

A range of models are available depending on the particular application. No final decision has yet been taken on the supplier although the recently announced decision to standardise on the IBM PC for the 'Shared' OCLC services will clearly have an impact on any decision. The range of models are

- I. A simple and cheap model to support the Online Public Catalogue.
- II. A staff access/edit terminal which can be used for a number of applications including cataloguing. This model will be able to operate both synchronously and asynchronously to allow the operator to interface with LS/2000 and the OCLC database.

- It will also, optionally, support the ALA character set.
- III. Data capture unit/staff access/edit - this terminal will be similar to the one described in II. except that it will incorporate a barcode reader/lightpen unit.
 - IV. A portable DCU with a barcode reader and some storage which can be used in mobile libraries and, also, as backup in the event of a system failure.

BARCODE READERS

OCLC will provide a range of barcode reading equipment to meet a library's requirements. This is particularly important where a library has been using a Circulation system of one kind or another and has a requirement to continue using the same barcode labels and readers. LS/2000 will support any format of barcode including all those currently used by library system suppliers.

5. SYSTEM FILES

In keeping with the concept and philosophy behind LS/2000, all the system files are integrated as much as possible. This not only ensures that the integrity of the system is preserved but also maximises the use of storage and reduces overheads and costs.

MASTER BIBLIOGRAPHIC FILE

This file contains the full MARC records (or a

stripped version of them) and is intimately linked with all the other files in LS/2000.

ITEM FILE

The item file contains a record of each loanable item in LS/2000 and includes such information as location, material type, circulation category, classification number, barcode number etc. Each item record is linked to its associated bibliographic record.

AUTHORITY FILE

Authority control can be established for any MARC field on the bibliographic record and the established headings are then linked to the headings in the MBF which are updated automatically to reflect any changes in the Authority File. The user determines which fields are to be authority-controlled at the profiling and installation stage.

TRANSACTION FILE

This file contains 'live' circulation transactions such as Checkouts, Checkins, Reservations etc. The transaction file is a temporary one which is continually being processed by LS/2000.

PATRON FILE

This file contains full details about each library patron and is updated to reflect any changes to that Patron's personal details or any changes the library may make to his loan

privileges in the library.

EXCEPTIONS FILE

This file contains item and patron records which have been accorded 'exception' status. This will occur for patrons who owe fines or have overdue items, and also for items which have been designated as 'lost' or 'damaged' etc.

CATALOGUE REVIEW FILE

This is a temporary workspace into which all new, changed and deleted bibliographic records are written IN ADDITION TO the Master Bibliographic File. Once in the Review File, the user can retrieve, view or amend them before approving or disapproving them for the MBF. In addition the system performs an algorithm for detecting potential duplicates in the MBF and copies candidate records into the review file for approval or disapproval.

PROFILES

LS/2000 maintains tables and lists of parameters which determine the way in which the system performs and controls operations; these parameters are determined at the profiling stage of a library's installation of LS/2000.

6. INDEXES

LS/2000 provides access to data by author, title, subject and keyword as part of the basic software package. In addition the user can specify which other fields in the MARC record should be indexed

and thus searchable; the user can specify ANY MARC field or group of fields (e.g. 110, 410, 610, 710 for Corporate Names).

Typical choices for these 'extra' indexes include

ISBN/ISSN
 Classification No.
 OCLC No.
 BNB No.
 Corporate names
 Conference names
 Series
 Date of publication

LS/2000 also builds authority files for user-determined fields in the MARC record. The system will also construct an index to the authority file which allows the user to search it.

7. PROFILES

All aspects of LS/2000 are profile driven and controlled by the user. Key profiling areas include

- I. Search Groups where the user defines which fields should be indexed and thus searchable.
- II. Loan Privileges where the user determines parameters such as Checkout period, daily fines etc. These Loan Privileges can be varied according to the location, the type of material and the patron category.
- III. Tables of valid MARC tags, indicators and subfields which LS/2000

- uses for various validation checks.
- IV. System parameters which enable the user to determine the way in which the system performs e.g. performance tuning, priority allocation, defining values such as Boolean search limits etc.
- V. Password control for staff where the library can define which members of staff are allowed access to which LS/2000 functions. This 'functional' control is just one of the levels of security available in LS/2000.

8. RANGE OF FACILITIES

AVAILABLE NOW

Circulation
 Authority control
 Cataloguing
 Public access catalogue
 Serials control
 Management information

UNDER DEVELOPMENT

Acquisitions
 'GATEWAY'

LS/2000 can operate either in standalone mode or clustered mode.

9. SUBSYSTEMS AND FUNCTIONS

There are five subsystems in LS/2000

- Circulation
- Online public catalogue
- Bibliographic

- Serials control
- Administrative

Each subsystem is introduced by a menu each of which features three display areas

- I. A list of the five subsystems
- II. A list of the General Functions. General Functions are available throughout LS/2000 and do not depend on the user being in any particular subsystem. General Functions allow the user to make changes of a practical nature such as print barcode labels, invoke the Mail system, and to change from menu-driven to command-driven interaction with the system (or vice-versa).
- III. A list of functions which are available through the subsystem menu currently being displayed.

10. LS/2000 FUNCTIONS**CATALOG ACCESS SUBSYSTEM****SUBSYSTEMS**

AS ADMINISTRATIVE
BS BIBLIOGRAPHIC

CAS CATALOG ACCESS
CS CIRCULATION

SCS SERIALS CONTROL

GENERAL FUNCTIONS

CON COMMENTS
DE DETAIL
EX EXPERIENCE
HE HELP

MA MAIL SYSTEM
PB PRINT BARCODE
PF PRINT FUNCTION
PT PRINT TEMP. LABELS

TD TIME & DATE

CATALOG ACCESS SUBSYSTEM

ES ENTER SEARCH TYPE
AU AUTHOR SEARCH
SU SUBJECT SEARCH

TI TITLE SEARCH
TM TERM SEARCH
OS OTHER SEARCHES

CIRCULATION SUBSYSTEM**SUBSYSTEMS**

AS ADMINISTRATIVE
BS BIBLIOGRAPHIC

CAS CATALOG ACCESS
CS CIRCULATION

SCS SERIALS CONTROL

GENERAL FUNCTIONS

CON COMMENTS
DE DETAIL
EX EXPERIENCE
HE HELP

MA MAIL SYSTEM
PB PRINT BARCODE
PF PRINT FUNCTION
PT PRINT TEMP. LABELS

TD TIME & DATE

CIRCULATION SUBSYSTEM

CA CART SYSTEM
CI CHECK IN
CO CHECK OUT
CX EXPENDABLE ITEM
FC FINE CORRECTION
FP FINE PAYMENT
FX FINE CANCELLATION
IL INTER LIBRARY LOAN
IS ITEM STATUS

LP LOAN PRIVILEGES
ME MESSAGE
MO MAIL OUT
NR NOTIFY RESERVE
PA PATRON ACTIVITY
PD PATRON DELETE
PP PRINT PULL SLIPS
PR PATRON REGISTRATION
PS PATRON STATUS

PU PULL
RC RECALL
RE RENEW
RI RECEIPT CHECK IN
RV RESERVE
SH SHELF
SS SET STATUS
VE VERIFY

BIBLIOGRAPHIC SUBSYSTEM

SUBSYSTEMS

AS ADMINISTRATIVE	CAS CATALOG ACCESS	SCS SERIALS CONTROL
BS BIBLIOGRAPHIC	CS CIRCULATION	

GENERAL FUNCTIONS

CON COMMENTS	MA MAIL SYSTEM	TD TIME & DATE
DE DETAIL	PB PRINT BARCODE	
EX EXPERIENCE	PP PRINT FUNCTION	
HE HELP	PT PRINT TEMP. LABELS	

BIBLIOGRAPHIC SUBSYSTEM

AN AUTHORITY FILE MAINT	IA INDICATORS ADD/EDIT	PB PRIORITY GROUPS
BE BIBLIOGRAPHIC ADD/EDIT	IE ITEM ADD/EDIT	PD PROCESS OCLC TAPE
CR CATALOG REVIEW	ID ITEM DELETE	ST SELECTION STRATEGIES
DC DICTIONARIES	LI LIST INDICATORS	TA TAG ADD/EDIT
FW FIND WORDS IN TAGS	OT OUTPUT TAGS	

SERIALS CONTROL SUBSYSTEM

SUBSYSTEMS

AS ADMINISTRATIVE	CAS CATALOG ACCESS	SCS SERIALS CONTROL
BS BIBLIOGRAPHIC	CS CIRCULATION	

GENERAL FUNCTIONS

CON COMMENTS	MA MAIL SYSTEM	TD TIME & DATE
DE DETAIL	PB PRINT BARCODE	
EX EXPERIENCE	PP PRINT FUNCTION	
HE HELP	PT PRINT TEMP. LABELS	

SERIALS CONTROL SUBSYSTEM

AR ADD ROUTING	SE SERIALS CHECK IN
----------------	---------------------

ADMINISTRATIVE SUBSYSTEM

SUBSYSTEMS

AS ADMINISTRATIVE	CAS CATALOG ACCESS	SCS SERIALS CONTROL
BS BIBLIOGRAPHIC	CS CIRCULATION	

GENERAL FUNCTIONS

CON COMMENTS	MA MAIL SYSTEM	TD TIME & DATE
DE DETAIL	PB PRINT BARCODE	
EX EXPERIENCE	PP PRINT FUNCTION	
HE HELP	PT PRINT TEMP. LABELS	

ADMINISTRATIVE SUBSYSTEM

AL AUTO-LOGOFF	PA FINE ACTIVITY	PQ PATRON FILE DEF
BB BATCH BILLING UPDATE	PR FINE REPORT	SA SYSTEM ACTIVITY
BP BILL PATRON	JI JOB INITIATION	SP SYSTEM PARAMETERS
CD CLOSED DAYS	JQ JOB QUEUE	UD USER DELETE
CP CIRCULATION PARAM.	LN LON OR MESSAGE	US USER ADD/EDIT
DA DEFINE ADDRESSES	OC OCLC INTERFACE PARAM	VR VIEW REPORTS
DP DOWN SYSTEM	PE PATRON EXPIRATION	

11. ONLINE PUBLIC CATALOGUE

The Online Public Catalogue is a very powerful subsystem offering a sophisticated and effective online facility for multiple users in the library.

Access to the OLPAC is available by Author, Title Subject and Keyword as part of the LS/2000 software. In addition the user is able to specify ANY MARC fields as an index key and thus render it searchable in the OLPAC.

The mechanism for retrieving bibliographic records from the OLPAC varies from search to search however the steps involved in a typical search are listed below

- I. Select the search key (author, title etc.)
- II. Enter the search key. The user may choose to truncate the search key.
- III. Browse through the resulting index display and select the appropriate record.
- IV. If there is more than one record in the chosen index entry, the system will display one-line citations of each which contain brief author, title and classification number information. Select the appropriate citation.
- V. The system displays a 'catalogue-card-type' image of the bibliographic record along with subject headings and brief copy/location/circulation status information.

- VI. Optionally the user can display the full MARC record.

Where keyword searches are performed, the system searches all of the indexes and commonly retrieves large sets of records. The user can set a threshold to the number of records in a retrieved set above which the system will invite the user to limit the search.

The user is able to limit the search by entering ANY other search key (including the user-specified ones); the system performs an implicit Boolean AND on the two sets of records and displays one-line citations of the records which match both search keys.

The index, citation and card-image displays are all designed to provide the user with a maximum amount of information, while at the same time preserving a clear, attractive and 'readable' image.

12. CIRCULATION SUBSYSTEM

The Circulation subsystem provides a wide range of facilities including all of the standard facilities

Checkout
Checkin
Reserve
Recall
Renew

EXCEPTION FILE

The system maintains an exception file of items and patrons which have been accorded 'exception' status (e.g. overdue items, patrons owing fines etc.). Where an item or patron record with 'exception' status is called up, LS/2000 provides the operator with an audible 'bleep' and a message indicating the reason for the 'exception' status.

LOAN PRIVILEGES

One of the most powerful features of LS/2000 is the flexibility available in the Loan Privileges afforded to different patrons in different circumstances.

The four Loan Privilege values are

- Checkout period
- Daily fine
- Maximum no. of renews
- Daily fine after renew

The library can assign different values to these Loan Privileges depending on

- I. The Patron category (or more precisely, his Borrowing Privilege Category)
- II. The location
- III. The type of material
- IV. The circulation category (e.g. lending, Reference, etc.)

The library is able to build a 4-dimensional matrix of the above characteristics, and assign different Loan Privileges to each cell of the

matrix.

THE CART FUNCTION

The Cart Function allows the user to establish a number of temporary or special locations known as Carts (or trolleys) and to assign items to that special location. The assignment of items to a Cart can be achieved by wandling the barcode as can the subsequent discharge.

Carts are normally established to identify shelving trolleys, or damaged item trolleys, at the Checkin desk. Other uses include trolleys of books on reserve, or awaiting cataloguing etc. The system records the Cart as a location in the library and a patron accessing a record in the Online Public Catalogue will be able to determine the whereabouts of a book from the Circulation Status display which all indicate e.g.

"SHELVED AT; RESERVE CART"

PARTON STATUS

Using the Patron Status function, the user can display full personal information about each patron as well as full details about his/her circulation activity e.g. item checked out; items on reserve etc. Where the patron owes fines, the system will present the user with a display of the overdue books, due dates, fines owing, and totals. In addition, the operator may record fine payment and the system will maintain a historical record of all financial transactions associated with that patron record. Patron records can be retrieved either by patron name or

by barcode number.

ITEM STATUS

The operator can retrieve a display showing the status of an item in the system. The display will include brief bibliographic details, the status of the item (i.e. whether on loan, location etc.) a list of reserves if any, and will alert the operator to the existence of any other copies in the system.

Item records can be retrieved throughout the Circulation subsystem by

Barcode no.
 Author
 Classification no.
 ISBN/ISSN
 LC Card no.
 Title acronym
 Author/title acronym
 Series
 OCLC no.

13. BIBLIOGRAPHIC SUBSYSTEM

LS/2000 accepts bibliographic data in any MARC format. The data can be derived from a number of sources

- I. Via the OCLC interface i.e. the operator is able to access LS/2000 and the OCLC database from the same terminal, and can transfer data from the latter to the former.
- II. By tape loading data e.g. OCLC subscription tapes; Selective Record

Service tapes; other machine-readable tapes.

- III. Direct input at the LS/2000 terminal.

The user can add local data (location, copy, classification number, barcode number etc.) to the bibliographic record either in the OCLC system or in LS/2000. LS/2000 generates the item records for each copy, indexes them according to the users instructions, and builds designated authority headings. Similarly, the operator can amend/delete bibliographic and item information.

AUTHORITY FILE MAINTENANCE

The authority files in LS/2000 are built according to user-defined parameters and retain automatic links to the headings in the Master Bibliographic File thus preserving the integrity of the database. The Authority Maintenance function allows the operator to add, amend or delete headings in the authority files. In addition, the operator may merge duplicate records and create cross references where appropriate.

CATALOGUE REVIEW FILE

LS/2000 maintains a Catalogue Review File into which all additions, amendments and deletions to the Master Bibliographic File are written. Once in the Review File, an authorised member of staff can retrieve, review, approve or disapprove, or edit them as appropriate. A number of simple commands enable the operator to approve or disapprove records either singly or 'en bloc'. In addition, LS/2000 contains an algorithm which

enables it to identify potential duplicate records in the MBF. When it does so it writes a copy of BOTH versions into the Review file for checking by the operator.

14. SERIALS CONTROL

The current version of LS/2000 contains a Serials Control Subsystem which enables the operator to perform simple check-in transaction for serial parts. In addition, the operator can prepare routing slips for the serial part.

An enhanced version of the Serials Control System is under development which will incorporate a number of the best features of the AVATAR version of ILS. The enhancements will include

- Complex displays of multi-institutional holdings
- Complex date-prediction algorithms
- Claiming facility
- Binding control

15. ADMINISTRATIVE SUBSYSTEM

The Administrative subsystem provides the library with control over various system parameters, authorisations and passwords, system performance, system operations and functional behaviour. Some of the key features are described below.

USER ADD/EDIT

This function allows the library to identify staff users, allocate passwords, and determine which functions he/she can and cannot access. This feature, in harness with a number of other

security features, provide the library with a great deal of control over system security.

DICTIONARIES

The Dictionaries contain tables and lists of values which LS/2000 uses to perform system and reference checks e.g. Lists of valid tags, stop-words, language codes etc.

Most important is the Search Group dictionaries where the user determines which fields and sub-fields will be indexed by LS/2000 and also which fields will be used to build authority files.

REPORTS

LS/2000 provides a number of offline and online reports which are the source of management information. The online reports are listed below.

The Circulation report provides a breakdown of the number of checkouts, checkins, reserves, renewals, recalls, etc. broken down by type of material.

The database report provides details of new, amended and deleted records broken down by type of material.

The offline output covers routine jobs such as overdue notices, reservation notices, patron lists, missing book lists etc.

FINE REPORT

This function provides a display of all fines

collected during the current working day including amount, receipt number, patron name and totals.

FINE ACTIVITY

The operator can retrieve a display of activity for a specified day, week, month or year. The display provides details of date, fine, receipt no., patron name and totals.



AUTOMATED LIBRARY SYSTEMS LIMITED

VECTOR HOUSE BROWNFIELDS WELWYN GARDEN CITY, HERTFORDSHIRE AL7 1AN ENGLAND

Telephone: WELWYN GARDEN (0456) 7073

Telex: 291254 ALS G

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38100 Grenoble
FRANCE
Tel. (33) 76 87 06 30

The online catalog revolution

Frederick Kilgour
Online Computer Library Center, Inc.
Dublin, Ohio
U.S.A.

The French historian, Fernand Braudel, in his Structures of Everyday Life, introduced his discussion of the spread of technology by saying,

"In a way, everything is technology: not only man's most strenuous endeavours but also his patient and monotonous efforts to make a mark on the external world; not only the rapid changes we are a little too ready to label revolutions (gunpowder, long-distance navigation, the printing-press, windmills and watermills, the first machines) but also the slow improvements in processes and tools, and those innumerable actions which may have no immediate innovating significance but which are the fruit of accumulated knowledge: the sailor rigging his boat, the miner digging a gallery, the peasant behind the plough or the smith at the anvil."(1)

Or the information seeker at the catalog! His catalog has taken many forms: manuscript book, printed book, slips, sheafs, cards, microfiche, and COM; and now it is online.

Library technology has not evolved as vigorously as technology in agriculture, manufacturing, power, transportation, communication, and even scholarly research. Indeed, with the exception of the last decade, library technological development can only be described as languid. Innovations of the past century and a half have been the card catalog, first in France in the 1830's (2) and a quarter century later in the United States (3); structured subject headings in 1843 (4); magazine article indexing in 1848 (5); narrow subject classification in 1873 (6); full-time reference service in 1884 (7); then there was a half-century hiatus until the early 1930's, when libraries began to implement microphotographic techniques (8); user-operated photocopying followed in 1960 (9) and COM catalogs in 1966 (10).

With respect to their effect on human life these advances in no way compare with the internal combustion engine (1876), central electric power generation (1882), the diesel engine (1897); the stationary gas turbine (1933), the automobile (1885), and the airplane (1903). Nor have library advances, technological or other, in any way kept pace with the dramatic developments in those other extenders of the human mind: telephony (1876), radio (1896), television (1907), and the computer (1945).

Although the twentieth century introduction into libraries of microphotography, xerography, and COM catalogs improved and enhanced library efficiency, they did not disintegrate the basic library concepts of subject

classification of materials or of catalog production employing bibliographic description and headings for subject access. Until the present, librarians have employed computers only to improve efficiency of cataloging, acquisitions, serials control, circulation control, and interlibrary lending, but have not made computer power the basis for radical changes in the philosophy and management of information delivery.

We all know that technology has played a significant role in the story of human society primarily by relieving people of simple, repetitive, imperative tasks such as food gathering, so that man may enjoy his uniquely human attributes. We are not always ready to recognize that technology has new, current roles to play in our own particular corner. We may marvel at twentieth-century technology having greatly enlarged our distinctive human experience, but all too often we resist when enlargement comes directly to us in our own little area for which we alone are responsible. Library users overwhelmingly accept online catalogs (11) but librarians do not share their enthusiasm.

The American photographic industry from the mid-nineteenth century to 1925, skillfully analyzed and described by Reese V. Jenkins, is an example of technological innovation causing dramatic change. The first major reorientation was the shift in the mid-1850s from the positive daguerreotype of 1839 to the new negative-positive collodion process. Next, about 1880, the gelatin plate wrought another reorientation in the industry, to be followed fifteen years later by the highly successful amateur roll-film system so widely available today. The last important change was the development of the movie film industry at the end of the first decade of the twentieth century.

Each of these four major shifts was basic within the industry and disrupted stable periods. Jenkins described each of them as, "Precedent-shattering technological change, generally with its revolutionary implications unperceived and often originating from outside the mainstream of the industry, triggered each time a redefinition of the broad technological boundaries within which practice could occur." (12)

It is computer power, however, that is bringing libraries to the brink of a precedent-shattering socio-technological change, as information seekers happily abandon their dependence on the traditional catalog, with its single—or at most dual—linear arrangement of entries, in favor of catalogs designed to provide a multitude of miniature catalogs of multi-dimensional design and accessible by many bibliographic and non-bibliographic avenues hitherto unavailable (13); and as they increasingly seek access to catalogs linked to electronic files of information by using personal computers in home, school and office.

Innovativeness, Purpose, Goals, and Objectives

The design of the public catalogs currently being developed does not—and should not—offer merely improvements in efficiency over earlier catalog designs. Like the jet airplane, which cannot be considered simply as a more efficient glider, the online catalog is a far more powerful instrument than any of its predecessors. It will profoundly change the way people go about the business of living, and its purpose must be expressed in societal concepts rather than in narrow bibliographic terms. No longer will catalogs be

restricted to enabling a person to find a book of which either the author, title, or subject is known; or to showing what a library has by an author, or on a subject, or in a specific field of literature; or to assisting in the choice of a book as to its edition or as to its being fiction or non-fiction (14).

The purpose of an online catalog is to promote the welfare and effectiveness of the people in the community it serves.

An online catalog should be designed to

- 1) continuously improve availability of information to all people in a community;
- 2) make information available one hundred percent of the time, when and where people need it;
- 3) personalize provision of information;
- 4) reduce people's cost, in both time and money; and
- 5) reduce maintenance costs relative to other types of catalogs.

To achieve the above goals an online catalog must

- 1) permit swift and accurate retrieval, 24 hours each day, 7 days each week, of catalog entries by bibliographic and non-bibliographic accesses;
- 2) permit retrieval of information from such diverse locations as dwellings, workplaces (including libraries), and educational institutions;
- 3) provide access to local, regional, national, and international collections of information.

Characteristics and Capabilities of Online Catalogs

An online public catalog can be thought of as comprising systematic listings of the contents of a collection of materials in a specific institution or organization interconnected with other such catalogs located in libraries, bookstores, and publishing houses, as well as with central union catalogs. Access to an online catalog, and those catalogs interconnected with it, should be available 24 hours a day, 7 days a week. In general, it should be possible for each personal computer, television set, or computer terminal accessing a given online catalog to also obtain access to every other online

catalog in the world, much as is the case with the international telephone system whereby it is possible for a given telephone instrument to be interconnected with almost any other telephone instrument.

Access techniques should be simple and easy to use, with both intellectual and physical manipulation held to an absolute minimum. In general, the system design should not expect the user to do such things as memorizing stopwords to improve system performance. As for indexing, it should be of the pre-coordinated type rather than the post-coordinated, which puts a burden on the user and a heavy burden on the computer. In a pre-coordinated system, the computer contains a miniature catalog listing the desired entry; in a post-coordinated or boolean system, the user must construct the miniature catalog, a tedious process for both user and computer.

Access should be by both bibliographic and non-bibliographic elements. Bibliographic elements should include combined author and title, as well as author and title separately. In addition, the user should be able to enter the catalog by non-bibliographic accesses; classification numbers, subject descriptors added to the catalog entry, and abbreviations of journal titles as found in the majority of references, as well as nicknames such as the "Green Journal". In addition, librarians and information scientists will need to use other non-bibliographic elements, such as International Standard Book Number and International Standard Serials Number.

It is also most desirable that online catalogs be accessible 24 hours day, 7 days a week, a possibility that is becoming real with the development of so-called "non-stop computers" that have the capability of automatically dialing a telephone number to report failure of a major component. To reduce operating costs it is also important that the catalog's computer not require human attendance or controlled environmental conditions.

System design must include access by personal computers, television sets, and general and specialized computer terminals even though use of the latter will probably be limited to professional information and library scientists. Provisions should also be made for access by new types of access devices such as voice access via microphone, as they are introduced, in the original system design.

To enhance the personalization of the provision of information, the online catalog should have the capability of printing out any of the miniature catalogs it introduces as a result of an individual's inquiry. The catalog should also be a participant in a telecommunication network that would permit the relay of a request to other libraries, to publishing houses, and particularly to collections of files of materials in electronic form, so that a document could be supplied almost as soon as it is located. Each online catalog should also have access to circulation records, so that a borrowing institution can know in advance whether or not an item is available at another institution.

The above characteristics and capabilities relate more to the general system design in which each online catalog should be a participant than to the actual use of an online catalog. There are several recent publications that report studies of utilization of online public access catalogs (15,16,17,18).

The major reductions in online catalog cost will come from computerizing descriptive cataloging with minimal human intervention. Online catalogs consist of multitudes of individual miniature catalogs, a concept that has

been discussed elsewhere (19). Except for perhaps the score of largest catalogs in the United States, the miniature catalogs of U.S. libraries will average three or fewer entries in author/title miniature catalogs produced as a result of an author/title search when OCLC pre-coordinated derived truncated search keys are used. Similarly, title entries in miniature catalogs will average two and a half entries or fewer. With such small catalogs, it will not be necessary to have extensive descriptive cataloging rule systems, such as the second edition of Anglo-American Cataloging Rules (20) and Regeln für die alphabetische Katalogisierung (21). If, as seems likely, it will be possible to develop a system of mechanized descriptive cataloging (22) once online catalogs are in full operation, large savings in the processing of books will result.

Contemplation

In the next few years online public catalogs accessed from remote devices will widely replace traditional forms of catalogs, and these wholly new catalogs will fulfill far broader and more important functions than classical catalogs. They will enlarge availability of information to individual users wherever they may be, while at the same time reducing users' costs to obtain information and institutional costs in maintaining and augmenting catalogs.

The most exciting prospect for the next several years is the integration of catalog and information supply functions, whereby it will be possible for the information seeker at his personal computer to obtain an item almost as rapidly as he can locate a catalog entry. The equivalent of a call number

pointing a user to a shelf will be an electronic pointer to an electronic document that is never "charged out," which resides in a remote file from which it can be retrieved instantly. The electronic files of documents currently coming into existence will soon be the logical equivalent, and replacement of, collections of publications in classical libraries, and libraries as we now know them will diminish in usefulness. The functions of librarians, as distinct from libraries, will, however, almost certainly enlarge intellectually as well as usefully.

The 1970's witnessed introduction of computerized processes into libraries that initiated change in the practices of librarianship; the 1980's will see initial transition away from traditional library collections and processes, while the 1990's will enjoy a wholly new information culture. The first moves to the new culture will be electronic files of documents and online public access catalogs.

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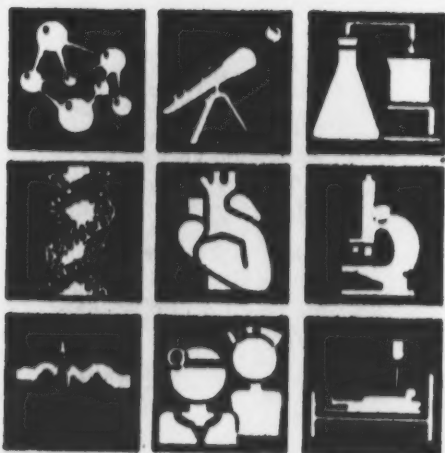
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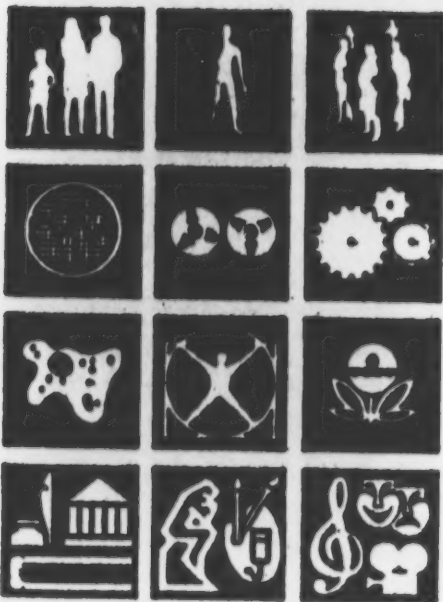
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The graceful integration of text and facsimile
in an electronic document delivery system

Thomas Hickey
Online Computer Library Center, Inc.
Dublin, Ohio
U.S.A.

The integration of graphics and text is a continuing problem for which there is no simple solution. This paper describes a prototype system under development at OCLC that uses the *T_EX* typesetting system's device independent (DVI) output as the basic file format in which all documents are stored, relying primarily on machine readable typesetting files from publishers for input. Digitized facsimile documents are transformed into DVI files using a novel character matching algorithm. At the cost of some processing time, the resulting file is extremely compact, and more easily transmitted to a variety of digital printers, than the original facsimile image.

INTRODUCTION

Within the Office of Research at OCLC, we are developing a prototype electronic document delivery system that will be able to print documents in libraries. Although the documents should look as much like the originals as possible, we are basing our system on stored characters rather than facsimile for three primary reasons: (1) the ease of storage and transmission of character-coded files; (2) the flexibility of this format for printing on a wide variety of output devices; and (3) the availability of such files generated during the publishing process. We are relying heavily on the typesetting software developed at Stanford University by Donald E. Knuth.¹

We have made several assumptions in the design of our system, and the most basic is that the delivered materials look like the original. However, we have relaxed the assumption, so that the delivered and original materials do not have to be *exactly* the same.

This assumption is the ideal. And, with the progress made in text processing and printers, it seems a reasonable goal. In fact, it appears that a properly designed system can obtain this similarity for only a little more money than a system that did not do it. How similar the delivered document has to look to the original is an open question. We are trying to format documents that would appear to a layman as a good-quality photocopy, but would not fool someone in the printing industry. We also hope that an introductory system can get along without graphics for at least a while. Without going to a full facsimile system, it appears that machine-readable graphics are several years away for most publications.

To be successful, the system will have to be price competitive with interlibrary loan to enable individual libraries to have a print station at low volume. (The cost for such a station is presently estimated at under \$10,000). We also believe that the system's ability to print documents immediately can make a huge difference in how the system is perceived

¹ Knuth, D. E. *T_EX and METAFONT, New Directions in Typesetting*. Providence: American Mathematical Society, 1979.

and used. This is especially true of users who do not make regular trips to the library; however, even for librarians, the response time will affect whether they treat it as fast interlibrary loan, or more as a replacement for on-site materials.

One of the basic goals of OCLC's research is to design a system relatively insensitive to changing technology, so that most of the system's software and database will not have to undergo continuous change to stay up-to-date. This requires us to maintain data in a format that assumes as little as possible about the ultimate display device. For our file format, we are using the *T_EX* typesetting system's device-independent output format called DVI. This file contains, in a well designed format, the characters needed to typeset the document and the font and position information.

We do not see such a system as a monolithic system in which everything anyone would want would be stored in a central site. Rather, the indexes would be stored centrally, and the textual material might be available over communications networks. Figure A gives an overview of one possible configuration. Files stored centrally would be in DVI format ready to be sent to the remote print stations. Files accessed over a network would be translated into DVI format before sending. This translation would not necessarily involve *T_EX*, but could be done directly, depending on the incoming format. Figure B shows the central system of our current prototype phase.

ACCOMMODATION OF FACSIMILE

In addition to character-coded files, we also need the capability to handle facsimile files. Without this, we will not be able to provide access to the huge amount of material that will probably never be converted into ASCII characters. In addition, much of the graphics that are to be merged into character-coded documents will be supplied in some sort of bit-image form. The question we posed to ourselves was whether such images could be handled in a way consistent with text. In other words, is it possible to convert images into DVI files, and if so, is it desirable to do so?

A number of problems are encountered when handling facsimile images, and we hoped to alleviate them with this approach. The first problem is scaling the images for different output devices. Facsimile images can be scaled directly, but the results are not always pleasing. It requires a fair amount of processing, which would have to be done concurrent with transmission of the image.

A more generally recognized problem with facsimile images is the large amount of storage required—typically 10 to 20 times the storage needed for stored-character files, even after the images have been highly compressed. The storage requirements are large, but they become truly important during transmission, making facsimile both slower and more

expensive to transmit than stored characters.

We would also like to convert all files into a consistent format to simplify our system. This is necessary, since we are trying to produce a well-designed prototype in a fairly short time with limited staff.

THE T_EX SYSTEM

Before describing our approach to integration, I will describe the environment in which we are trying to integrate facsimile—the T_EX typesetting environment. The most important file format is the DVI format, which contains the character identification and position information.

DVI files are designed to be the output format of typesetting programs, such as T_EX. The file consists of position and identification information for each character and position and size information for rules. A high degree of compaction is achieved by making most of the information implicit—each character has a natural width, and if the next character on the line falls where this natural width would put it, then no further position information is needed. The format has a fairly complex system of nesting, stacks, and position incrementing commands, which further help in producing a compact file. All dimension values and even character codes can be one, two, three, or four eight-bit bytes long. There are one-byte commands to set the first 128 characters in each font, and 64 one-byte commands to select fonts. Although storage overhead is required to maintain the position information, this is typically less than 25 percent of a source document expressed in T_EX.

The DVI file does not contain any information on what the individual characters look like (i.e., the character images). The DVI file simply identifies the font and points to the character within it. The DVI file, if properly constructed, should produce essentially the same output independent of the ultimate resolution of the printer. In fact, there is no way to specify the type of printer to T_EX, although a parameter to control magnification of the image is available. The character images are held in a variety of formats. We are presently using one called PXL³ and a variant that has the image information compressed (using run-length coding).

In our system, these images have been generated specifically for the output printing device by a program called METAFONT. This requires a different set of fonts for each resolution we want to support. We have a large repertoire of METAFONT character definitions from which images can be generated for a wide range of digital output devices.

³ Fuchs, D. "The format of PXL files." *TUGboat, the T_EX Users Group Newsletter* 2(3):9-12, 1981.

For each single font character, the PXL file contains both a bit-image and nominal width, which are needed by the printing programs. When a DVI file is combined with the appropriate set of PXL files, a digital image of the page suitable for sending to digital printers and displays can be formed.

A third format is the TFM format. TFM, or TeX Font Metric, files contain the information that TeX needs to generate the DVI file when processing a TeX source file. This includes information on character widths (for positioning), heights, and depths (for accent placement and interlinespacing), kerning (to adjust the position between certain pairs of letters), ligatures (to substitute single characters for combinations), italic corrections (for spacing in the transition from slanted to straight), and information enabling TeX to construct built-up characters, such as oversized parentheses.

These formats are designed very much from a typesetter's view. Although there are some restrictions to the formats, they are capable of accommodating typesetting of the highest quality. This capability is important in a system that is expected to have a reasonable lifetime.

OUR APPROACH

Our goals were to achieve considerable compression while preserving the original appearance of the page. The processing time required was of secondary importance, since special-purpose processors will most likely be able to do much of the computing economically. The basic approach is to locate characters in the facsimile image and to match similar characters so that only one image of each type of character needs to be stored. In other words, all the lower case A's of a certain font are to be identified, all the lower case B's, etc. The position information for these characters is then output to a DVI file, and the font information forms PXL files. It should be emphasized that this is not what is usually considered 'optical character recognition.' Similar characters within the document are being brought together, but the proper character code they would represent is not identified; rather, a code is assigned arbitrarily. This simplifies the process considerably. Lower case A's from different fonts are not identified as the same character and are treated independently. Although we developed this idea ourselves, we were not the first. Ascher³ describes a system similar in many ways to what is described here.

Our current method of breaking an image into individual characters first finds a black pixel on the page, and then considers every pixel that is eight-way contiguous to that

³ Ascher, R. N.; Nagy, G. "A means for achieving a high degree of compaction on scan-digitized printed text." *IEEE Transactions on Computers* C-23(11):1174-1179, 1974.

pixel as part of the same character. This has the curious result that the dot of a lower case *i* is not considered part of the rest of the letter. In fact, during the matching process, that dot may well be mapped to the same character image that the period and the dots in colons, exclamation points, and question marks are mapped to. We are currently using a recursive algorithm to locate contiguous dots, but we have tested and plan to incorporate a sophisticated one-pass algorithm that does not require the full page to be available at one time to locate characters.⁴

As an example the following METAFONT proof mode image of a lower case *A* and the corresponding font which can be used to generate it:



Once the character has been located, it has to be matched to previous characters to see if it is a new character or one similar enough to a previously scanned character to be considered identical. Since our experimentation to date has used only constructed bit images, we have implemented only an exact match (although Ascher gives a reasonable approach for partial matching). The matching process can be accelerated by constructing a tree of the character images based on any of a number of qualities associated with the image. We are currently using character width and height as searching parameters, but other qualities include the overall density and the optical balance of the image.

Once the characters have been identified, it remains to generate PXL and OVI files that can in turn reproduce the original image. This can be done in a fairly straightforward manner, but for maximum compression a number of optimizations need to be done. One of the most important is to properly identify the 'natural' width of each character so that the majority can be placed on the page without having to have position information inserted between each one (which can easily double or triple the size of the file). Information

⁴ Lutz, R. K. "An algorithm for the real time analysis of digitized images." *The Computer Journal* 23(3):262-269, 1980.

for computing this width needs to be collected during the character-matching process. Another problem is collecting contiguous characters into the same font so that a multitude of font changes are not required in the DVI file. Our best approach at present is to sort character images by frequency. This way, at least the most common 128 images are in a basic font, and shifts to characters in other fonts are much less common.

One of the main drawbacks of this approach is that the text of the resulting files are not searchable because we have not gone 'all the way' and assigned the proper character code to each character. This may be possible some time in the future, but at present it involves a great deal of human effort to make a generalized character recognition system work. Another problem is the amount of processing time involved. On an Apollo DM420 processor (Motorola 68000 based), processing a typical page could take several minutes. There are a number of optimizations that could be made to the program to increase its speed; however, for a production system, we would expect to use a special-purpose processor, either one specifically designed for image processing or a more general-purpose array processor. These computers are fast enough so that images could be processed in the time required to scan them.

The main benefit of this approach is in the extremely compact storage. With sophisticated matching and optimization of output files, we hope to come within a factor of two of the DVI file as it would be generated by TeX (given the original text). This is something like a factor of ten better than a more straightforward compression algorithm that makes no attempt at global recognition and compression. We are convinced that this compression factor becomes even greater as scanning resolution increases.

In addition to reducing storage costs, smaller files mean that, for a given print speed, transmission bandwidth is reduced. Scaling the documents to accommodate different resolutions can be accomplished by simply scaling the fonts associated with the document. Since this might be done a number of times (probably during transmission), a significant reduction could be achieved. We have done some work in high-quality scaling of character images by automatically fitting spline curves to them (which could only be considered if the characters have been broken out of the documents). Finally, having facsimile documents stored in the same format as other documents simplifies transmission protocols and software at a number of levels.

A number of questions remain to be answered. What ultimate compression will be obtained with documents scanned at high resolution is unknown. In part, compression will rely on the sophistication of the matching algorithms that are in a rudimentary state at this time. Currently, there are definite hardware limitations in the resolution that can be

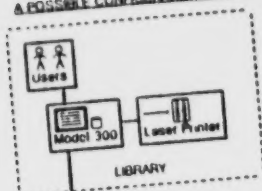
obtained using reasonably priced scanners and general-purpose computers. For instance, a digital camera scanning an A4 page (210 x 297 mm) at 100 pixels/cm will generate more than 4,000,000 pixels, each eight-bits deep. This is output at a rate of more than one megabyte/sec, a faster transfer rate than most computers can accommodate for any length of time. Adding color would triple the data available. Unfortunately, 100 pixels/cm is a marginal scanning resolution for many library materials. If the scanned images are to be retained for the indefinite future, then we would like to capture them at as high a resolution as possible to avoid repeating the relatively expensive scanning process. This requires something more like 200 pixels/cm, which generates more than 16,000,000 pixels per scanned page. If this image were stored uncompressed, only three pages would fit on a standard 2400 foot, 1600 bpi magnetic tape.

Another question that needs to be addressed in the matching phase is What do you do after two characters are found to be similar? Is only the image of the first retained, or could the two be somehow merged to achieve a higher quality master image (or at least an image intermediate between the two)? This process would have to be well-defined for extension to handling a series of similar, but not identical, characters.

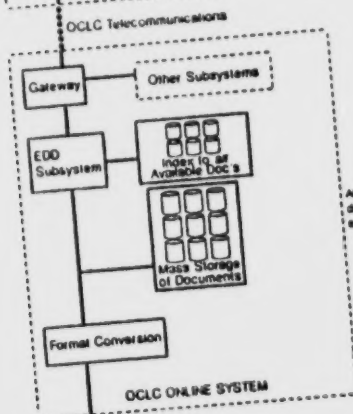
CONCLUSION

There is no doubt that graphics must be provided in electronically delivered documents. I have presented here one approach that essentially generalizes the idea of characters and text to include the ability to handle graphics. This results in an integrated system that can handle facsimile images as well as documents provided in machine-readable form.

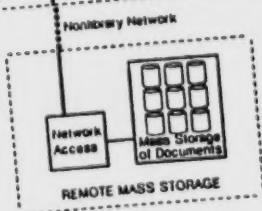
A POSSIBLE CONFIGURATION FOR OCLC'S ELECTRONIC DOCUMENT DELIVERY SYSTEM



Users could either be patrons or library staff. In addition to laser printers, output could be to facsimile devices or even (unformatted) to 'dumb' printers. It seems essential not to be dependent on a single type of printer.



At first, OCLC will store all machine-readable documents locally. Total reliance on central storage will probably prove impractical.



Future participants (suppliers) are publishers' consortia, scientific societies, and specialized library collections.

Figure A

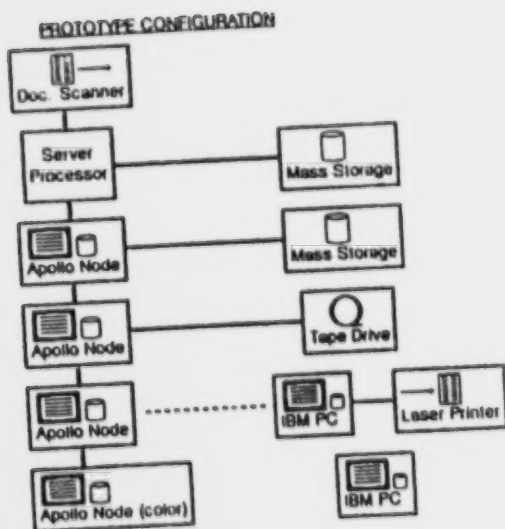


Figure 8

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Delivery systems: beyond access

S u s a n M a r t i n
John Hopkins University
Milton S. Eisenhower Library
Baltimore, Maryland
U.S.A.

For many years librarians have complained that our systems of bibliographic and text access are improving while the systems of document delivery remain the same - slow and cumbersome. We hurry up, only to wait. We can determine exactly who owns a desired book or journal, by depressing a few keys at a computer terminal, and it takes mere seconds to find this information. But what happens next? We request a book or a photocopy, and we tell the library patron not to expect it for at least two weeks!

Why? We all know the answer to this question. At the point that the online request is made, traditional manual systems take over at the other end. Someone goes to the shelf to retrieve the item, perhaps to find that it's missing. Searching for the lost book is, of course, handled by a different department of the library. Forget the inter-library loan; the fates never intended that you borrow that book, at least not from that library.

Even if the book or journal is on the shelf, the process seems interminable. Different libraries have varying policies about interlibrary loan; the response differs considerably depending upon the method of delivery. The post office is a poor cousin when compared with special delivery services, and libraries in regions which have a daily delivery truck are even more fortunate and more rare.

I see the results of the "hurry up and wait" phenomenon, with some pain, revealed every month by the statistics generated by RLG's RLIN system. As a borrower, John Hopkins University is able to place ILL requests online in minutes. In May 1983, we requested 242 items from other RLG libraries. The average on-line response time was 4.1 days, and the average number of additional days to receive the item was 5.3, or more than one week.

And this from a network which has placed a premium on rapid response to ILL requests, in an effort to realistically share resources.

In some ways even more discouraging are the university's statistics as a lender. Our average response time

to requesting libraries is 1.6 days -- much better than the network average -- but it still takes our books an average of 5.5 additional days to reach the requesting library.

In fact, document and information delivery is becoming an extremely complex function, not only within libraries but also in society in general. At the risk of repeating some points which have already been brought out, I want to identify what tools are available, which ones are missing, what techniques are being developed, and dwell for a short time on some questions and issues which we often tend to brush aside.

WHAT TOOLS ARE AVAILABLE

As you've been hearing during this conference, we have already built much of the electronic structure which will provide us with information about where material is located. Among these are the following:

- 1) Bibliographic Systems in the U.S. (examples which can be used universally)

OCLC, RLIN, and WLN are the largest on-line library bibliographic systems in this country, but other local and regional systems exist. Although OCLC began as a cataloging system and did not implement its formal inter-library loan module until 1979, these systems have been used by libraries from the very beginning as sources of location information. Now, most of the systems contain ILL/document delivery modules. An OCLC user can find 50 or 60 million location symbols, and may then request material through interlibrary loan. As a result, some interesting phenomena can be noted. First, smaller libraries have found a large increase in their interlibrary lending; they typically catalog books sooner than large libraries and are speedier in lending. Second, ILL librarians have become more aware of those lending institutions which respond

rapidly, and increasingly avoid the lenders which are slow (read "inefficient").

Gradually, more libraries are making OCLC terminals available in public service areas. Patrons therefore discover items which are held by other libraries, but they are not able to request the material directly. The result: more interlibrary borrowing, and some degree of frustration on the part of the patron who may be quite computer-literate and otherwise self-sufficient when placed in front of a computer terminal.

2) Ordering Systems

In development for years but available on a wide scale only recently are the online systems whereby librarians can order by computer from vendors or book jobbers. From Bowker, which has mounted the Books In Print data base on-line, to Brodart's acquisitions initiative, to serials jobbers such as Faxon and Ebsco, a wide selection of systems and vendors is available.

An unusual application which falls into the "ordering" category is that of USBE -- the Universal Serials and Book Exchange. Several thousand serial titles reflect the USBE location code in the OCLC system. An interlibrary loan librarian becomes an acquisitions librarian by requesting a volume or an issue from USBE, because this transaction is a purchase rather than a loan. Offering a superb way to avoid the copyright question, the USBE - OCLC link is used increasingly heavily.

Perhaps representative of the trend toward ordering systems is the Res. Lib. Group, which just polled its members to discover how many would be interested in on-line ordering through RLIN.

I believe, though, that we "hurry up and wait" with these systems as well. Once the jobber or publisher has received the on-line order, the same manual system takes over to deliver the item to the library. Is it

reasonable to save three days in the ordering process when it continues to take two to three weeks to deliver even a domestic publication? The answer may be that it is reasonable, but only because of the time and effort saved by eliminating the paperwork of typing orders and performing fund accounting. The actual saving of time may be irrelevant.

3) Reference Systems

On-line information retrieval has been greatly enhanced by the implementation of ordering, or document delivery, systems such as DIALOG's DIALORDER. More like a message switching system than a bibliographic system, documents can be ordered from suppliers whether or not the bibliographic data are represented in the on-line data base. For example, a vendor can establish an account without loading data into the system; the customers of the information retrieval service are advised that they are now able to order from that vendor, using the system's messaging capabilities.

The capability to order directly from document supplier is significant, as mentioned this morning. As with direct ordering from book jobbers, libraries may find considerable savings in staff time in processing requests and keeping track of accounting. Although document suppliers are using a single communications vehicle for receiving orders, standardization ends there. Not all publishers are suppliers, not all suppliers are publishers, and the confusion expands to fill the available possibilities. Finally the reference systems' ordering functions may suffer from similar "hurry up and wait" problems as do the ordering systems, although these suppliers are likely to use more technologically innovative ways of delivering information.

4) Circulation Systems

I return to the mundane and familiar when we discuss circulation or issuing systems. Of course, these systems limit our perusal to those materials held locally. But there is ample reason to include circulation systems as an important part of our document delivery structure.

Libraries have many years of experience with circulation systems, and the first U.S. turn-key commercial circulation system became available in 1970. The combination of experience and competition has provided the stimulus for expanding these systems beyond the original function of straightforward housekeeping, toward an emphasis on direct user service. In some libraries, a full retrospective conversion has been completed, with the data base available to the circulation system. Elsewhere, the on-line circulation data bases comprise records from current cataloging, current circulation, or a combination.

Particularly important is the ability of the user to check the circulation system directly, perhaps from his home using dial access. Many circulation systems have expanded to include the public access capability, but with attendant problems. Perhaps the problem of most concern to me is the user's reaction to an incomplete data base, in the large number of libraries which have not converted retrospectively. We know that users are unlikely to check a second file or catalog; if a user queries the circulation system about a specific title and does not find the title, he or she may leave the library believing that the title is not in the collection, not realizing that it may be an older title which has not circulated since the implementation of the system.

Another concern, particularly within academic and special libraries, is the user's wish to know who has checked out the desired book. A familiar user's plea is, "Only four people in this institution are doing work in high energy physics; we all work together and it must be

one of the other three. They wouldn't mind if you tell me who has the book." A library administrator can tactfully turn aside this request for such an unusual form of document delivery, but a student employee at the circulation desk will find it almost impossible to say no to a faculty member.

Local circulation systems help to improve document delivery by providing the means whereby users can place their own holds, or reserves. To the extent that a library is able to direct its users to a burgeoning number of local and remote services, the circulation system provides a building block toward providing access to a variety of information sources from one terminal.

5) Telecopying

Familiar and unsophisticated means of document delivery is telecopying, or telefacsimile. It lacks the glamor of on-line systems, and assuredly lacks the cost. But it no longer takes five or six minutes to transmit a page; with the better copiers transmission may be as brief as 45 seconds.

Now a library can receive requests for photocopies, locate the material, and send the item off that day or the following morning.

Does this technology solve the "hurry up and wait" problem? Only partially. First, there must be someone on the receiving end with a compatible telecopier. Most libraries in the U.S. don't own or lease them, with the exception of such major projects as that run by the Pacific Northwest Bibliographic Center. Second, telecopying is best for those items which you would normally photocopy and send such as journal articles. It would be incredibly time-consuming and possibly illegal to transmit the contents of an entire book. Third, it is still necessary to photocopy the pages to prepare them for telefacsimile. The technology has not yet been implemented to allow a two-page spread

of a book to be placed on a platen and telecopied. Therefore, telefacsimile helps the document delivery process, but represents only part of the ideal solution.

WHAT'S MISSING

The systems I have just described, when linked, represent the inputs and outputs of a document delivery system. Each piece exists, independently and not developed to perfection. Before they can be put together to respond to our document delivery needs, some pieces of the jigsaw puzzle must be created out of whole cloth, and others are in development and need additional work.

Undoubtedly many items are in the "missing" category. I have identified four which I consider to be particularly crucial: I am sure you could add to the list.

a) Black Box, or special interface

We need a black box which will allow us to access all these systems with one terminal. The black box I have in mind is likely to be a powerful microcomputer, with software to support different kinds of queries, telecommunications protocols to access remote data, a message-switching capability, and accounting software.

If this black box existed, a library would purchase one, install it in the library, and link it to the desired bibliographic systems, reference and retrieval systems, and ordering systems, as well as to local systems. A librarian or a user would sit at a standard terminal, use a standardized query language to formulate requests and receive responses. The accounting software would keep track of activity, and provide the library with management information. After all, these services would be free, and the library would receive invoices regularly from all its

suppliers.

Document delivery will be achieved by using the black box, too. Now, in 1983, the full text of many journals is available on-line. In the future there will be expansion of computer-based electronic publishing, as well as systems based upon optical disk storage of full text. The smart box will allow us to request and receive documents from publicly available computer-readable files, and then will keep track of our expenditures for these documents.

An entrepreneur out there should recognize that this kind of technological interface will be essential in the future. The black box is missing now, but is likely to find its way into our systems in the near future, to facilitate access to bibliographic data and to any full-text documents already in machine-readable form.

b) We have long bemoaned the fact that access to our various on-line systems is, so to speak, various. No standard query language exists; indeed, we are fortunate that the protocols for computer-to-computer communication now exist in the early stages of development. There's a different language for each of 250 data base distributors.

If the black box is to function, we need query language software to allow us access to all the systems. A standardized query language is not mandatory for achievement of the link among systems, but as librarians and users move from one library to another, they will need a standard language. In the U.S. we have had for eight decades a standardized access in the form of the card catalog based on the Library of Congress; as we choose different computer systems, we are undermining the standard access to which library

users have become accustomed.

c) Linking Holdings

In an article I wrote more than seven years ago, I predicted that on-line bibliographic tools would expand such that location information would be available to anyone searching reference data bases. The Mechanized Information Center at Ohio State University developed a system over a decade ago whereby tapes received from abstracting and indexing services were matched against the library's data base and researchers' SDI profiles. Any hits resulted in a postcard to be sent to the researcher, with the local call number for titles held locally.

That's approaching the ideal. To be able to query a large data base and to determine not only which titles are relevant but also where they may be found, is a goal toward which we should be moving. But such movement, if it exists at all, is virtually imperceptible.

These links are nonexistent for at least two major reasons. First, the resulting network of information would be complex; the logic is relatively easy to describe, but the details of the structure give rise to many questions. Where would the information be linked: at the local level, the vendor level, or elsewhere? Without standards, is it possible to match local library information to vendor-supplied data? Who would perform this task, and, most importantly, where are the economic gains? If a linked system were easy to achieve and were perceived as profitable some vendor would already have done it. Second, the network of information represents the dovetailing of library catalog bibliographic data with on-line reference bibliographic data. In the U.S. catalog information has usually been pro-

duced by LC or a library, following standard cataloging rules. The reference data are produced by abstracting and indexing services, which tend to use different machine-readable formats and different authority files. Once again, it has not been economically advantageous for one or more vendors to incorporate a location capacity within the reference data base. The two types of files remain separate, leaving librarians and users to take additional steps to bring the information together.

WHAT'S BEING DEVELOPED

A part of the difficult jigsaw puzzle of document delivery is composed of some technological areas under development. You are aware of them, I know, but I would like to list and describe the more important ones as we consider the document delivery issue.

Typically, these technologies are not standardized or compatible, with telefacsimile (the oldest one) being an exception. It is the lack of compatibility which makes it almost impossible for a standardized library profession to cope easily with the entrepreneurial and proprietary competitiveness. Let's look at some developing mechanisms:

Optical Disc

Easily the most publicized new technology, optical disc is evolving so rapidly that my comments here may even now be out of date. Optical disc is assumed to be the successor of microform, in terms of preservation of print material. It is also expected to be a medium for publication of lower-demand scholarly journals. Information can be recorded on optical disc in either analog or digital form; the latter is likely to be more susceptible to search and transfer of material because it is more easily in-

dexed.

Suddenly many companies are in the optical disc business, although library applications are thus far restricted to large-scale projects such as the Library of Congress, major research ventures, or small test projects. Microforms never did standardize fully; optical discs are starting life without standards and promise to pose a difficulty even more severe than microforms.

Although little discussion has occurred about the interaction among libraries when they have information on optical disc, I assume that such interaction will occur, and that it will be possible for libraries to "deliver" documents quickly if they are already on disc. The legal and business questions will be resolved with relative ease, possibly by using existing policies for interlibrary loan.

Optical disc as used by suppliers, as with the now defunct Adonis Project, presents different issues. It is likely that libraries will become customers of commercial optical disc systems, just as they are now customers of information retrieval systems. The document delivery will be speedy; the economics will be problematic; the range of possible sources will pose difficulties.

A scenario can be visualized for commercial suppliers of information that is available only for optical disc. Services such as Dialog, Orbit and BRS may evolve. A library, in this case, may subscribe to one or more of these services. The increased availability of information will be incredibly useful -- a major step forward. However, the problems which may arise are worrisome. The existence of more than one service may mean more than one configuration of equipment. The current issues of subsidy will become complicated indeed with this scenario. To what extent can a library subsidize the acquisition of articles and other documents for its users?

Electronic Publishing and Delivery

Rapid movement is taking place in the areas of electronic publishing and delivery of full text in computer-readable form. By the end of this year, dozens of journals will be available in electronic form, either in addition to hard copy or instead of hard copy.

Several issues require resolution in the use of electronic publications. The cost of the systems is an obvious barrier. In England, the International Research Communication System (IRCS) has calculated that it will cost \$ 50 per connect hour to consult their files, while experts in the U.S. have estimated that journal articles provided on-line will cost at least \$ 5 per article, far more than most people now pay to read journals. If the journal is provided in hard copy, "traditional" access is available. However, if the journal is only in electronic form, readers will incur a charge for each use. An electronic structure such as this one can be harmful not only to readers but also to publishers, who may earn less from these publications.

A second concern is the capacity of current electronic distribution to handle nontext information such as graphs, photos, and tables, not to mention any advertising matter. Elsevier has considered annotating electronic publications with references to deleted nontextual material, and establishing a document delivery service to allow users to request the complete work.

Telecopying

Telecopying, or telefacsimile, is improving "with all deliberate speed." The amount of time required to transmit a page has dropped significantly in recent years, and the quality of the output is far superior to the output of a decade ago.

WHAT WE FORGET

In its haste to adopt new and rapid techniques of document delivery, our profession often overlooks the importance of optimizing existing structures which appear old-fashioned. On-line computer access is seductive, as are newer technologies. Isn't it wonderful to think that the entire contents of the Library of Congress can be stored in a cube measuring one inch square? That was the dream of the 1960's. In the 1980's, we continue to dream about vast amounts of machine-readable information located in someone else's library or in a supplier's data base, accessible at our library by pressing a few buttons.

Unquestionably, we have moved strongly in this direction, and information technologies will continue to provide us with expanding and interesting alternatives for delivering material to users. What we forget is that a balance of older and innovative technologies is most likely to supply an economical, yet responsive, support system for library users. A few examples will illustrate this point.

Many libraries in the U.S. force users to bring books in to renew them; some even have policies against renewals altogether. In a sense, telephone renewals constitute document delivery, and they are clearly technologically oriented. Computers and communications are becoming increasingly linked; telephone renewals allow users to employ communications technologies, and with automated circulation systems in place, the renewal is entered into the computer. All the machinery is in place to permit material to be in the hands of the user who most needs it at the time.

Then there's selective dissemination of information, or SDI. The Ohio State system described earlier was an SDI system. Somehow, when on-line systems became not only fashionable but economically within reach, we lost sight of SDI. SDI is a superb technique for someone who needs to keep abreast of particular topics and does not

need to visit the library monthly to submit the same search request. The concept of a standing order for information recently published is a lifesaver for many researchers; they would receive a monthly list, generated automatically by current updates to reference and cataloging data bases. They wouldn't need the text at first; but would scan the citations to make selections. Needless to say, SDI is a document delivery technique which should be ignored.

Among the items we forget or minimize is the simplest strategem of all: place the book or photocopy in the person's hand. In 1976, the libraries at UC Berkeley and Stanford University began a program of cooperation which resulted in virtually treating the two collections as one. A faculty member at Berkeley could request a Stanford book and receive it within one day. Berkeley's own campus delivery system made it possible for that same professor to request a Berkeley book to be charged out and sent to his or her department office.

I liked that idea. At John Hopkins University, we have implemented the same system, on a far smaller scale. Faculty who wish books or articles can request by telephone that they be sent to the department office. Even more exciting, we are close to implementing a system whereby faculty with personal computers or terminals can key in their requests to the library file on the campus computer. At the same time, they can indicate whether they wish to initiate an interlibrary loan transaction if we do not own the book. A free-form message structure allows them to ask us to order the book for the collection, or to send any other kind of message.

Our system for campus document delivery costs under \$ 20,000 annually. We fill between 1500 and 2000 requests per year, and still find that many people on campus have not yet heard about the service. Simple and straightforward, the local document delivery program takes advantage of local resources, identifies gaps in the collection and provides a direct interface to ILL and acquisitions.

Next, it should be connected to the reference data base and ordering systems.

ISSUES

In the discussion of document delivery, certain questions are sometimes asked but never resolved. These questions are important ones. For example, how quickly does anyone (or everyone) really need information -- information that is in machine-readable form, bibliographic records, citations. The answer probably varies, depending upon the person. We are now accustomed to systems which deliver information in seconds or minutes. We could probably wait half a day or one day, but our patience level no longer extends to that degree. My guess is that usually people don't need the answer to a question ("where" and "what") immediately, but our society has persuaded them that they do. Expectation levels have risen in response to our systems.

But the next question is more important, especially since we have yet to solve all the economic and logistical problems. Let me repeat the question, How quickly does anyone need the document? Does it matter that we hurry up and wait? I think not. Yes, some researchers may need an article immediately, but these occasions are unusual. The undergraduate always needs the document yesterday, for the term paper due tomorrow. Most other scholars can wait; if they truly cannot wait, the librarian should consider buying the work, since it may be significant.

If my hypothesis is correct, that most users do not need the material immediately, we must look at our delivery systems rather differently. The speed of access to documents is a by-product of the technologies available to us, rather than a representation of actual requirements. As long as access is not economically harmful, we can accept and enjoy the speed. But we need to know whether the price

is worth the extra effort to gain speed in document delivery. For example, we might have two levels of delivery: normal speed (a few days) and rapid (from instantaneous to 24 hours). The user should be asked to pay a premium for rapid delivery, eliminating the syndrome whereby everything is termed "rush".

Questions barely alluded to involve those of copy-right. When we have access to electronic texts, will we have to pay for every use of an item, including browsing? In many ways, licensing seems more reasonable. The library would license a data base for one year, presuming a certain level and type of use. If actual use is lighter or heavier than anticipated, the next year's license would be altered correspondingly. None of the material would be owned by the library; it would merely have access to a file for the duration of the license. Should a user request hard copy from the data base, an additional charge would be incurred; the library could subsidize it fully, charge the user fully, or adopt intermediate strategies.

I have referred several times to the increasing complexity of our document delivery systems. Library staffs must become aware of the variety of sources of data and information, in order to inform users, who do not spend most of their time figuring out what's available. The level of staff in libraries must be sufficient to serve the needs of users. This means that we will require more and better trained staff to sort through the growing maze of information. Costs for staff can be justified only if we can show a payoff to users. Staff will have to undergo "lifelong learning" to keep abreast of innovative information technologies and to decide which of the existing systems are appropriate for the local situation. For example, library staff may determine that the library needs to subscribe to two optical disc data services, and one computer data base service, and that it needs a local delivery system. To management, justifications and explanations are critical. In sum, tomorrow's librarian will have to have sufficient

knowledge to use both the traditional and the innovative library.

People will be able to use information services directly, without the mediation of the library. Many will say that this event will signal the end of the library, and that as more information-seekers establish accounts with on-line services, libraries will become museums of the past.

Libraries will not disappear. If information systems are truly becoming increasingly complex, people will need information professionals to sort through all the available services, costs, and capabilities. After all, we represent the profession which focuses entirely upon the gathering and distribution of information. At the front end, we must deal with all kinds of suppliers and every format; at the output side, we work with all kinds of users and their demands. In this role, libraries are alone. Because public service librarians spend their days in this endeavor, their ability to identify the right information source should by definition be more skilled than those of users who access information sources less frequently in the course of their lives.

Electronic publications will represent an anarchy of information; formats, standards, and equipment will vary widely. To make any sense of this new environment, it will be necessary to improve access mechanisms. We have already accomplished this for our book collections; the task is analogous, although possibly more difficult, for electronic publications.

This year, and this decade, we are witnessing a society enamoured of technology, computers, video games, information systems, and other things that sparkle, cost a lot of money, and take time to master. The information jigsaw puzzle which our society is putting together is complex indeed; the average user will soon grow impatient with the need to learn different query languages, work with different keyboards, and in other ways take time from his

daily pursuits.

The document delivery structure is an important part of the jigsaw puzzle. Our task is to design the next pieces of the puzzle to incorporate both rapid delivery and the "hurry up and wait" delivery, into a smoothly flowing communication channel which provides the appropriate amount and type of information at an affordable cost, with acceptable speed. It is a task just under way, with exciting prospects, varying options, and one which will be the library's major effort well into the 21st century.



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Electronic publishing:
some observations evolving from our experience

O l d r i c h S t a n d e r a
University of Calgary, Library
Calgary, Alberta
Canada

ELECTRONIC PUBLISHING: SOME OBSERVATIONS EVOLVING
FROM OUR EXPERIENCE

O.L. Standera
The University of Calgary

1. INTRODUCTION

The recent leaps in technology did not leave conventional publishing methods unaffected. Publishers, printers, providers of hardware, software and related services, libraries and scholars in general began reassessing their respective positions.

The University of Calgary, through the involvement of its University Press and the University of Calgary Libraries and with the financial assistance of the Social Sciences and Humanities Research Council of Canada, has launched a Research Project encompassing two phases over the period of one year.

The Phase I, which has been concluded, has seen creation of an electronic journal of ten papers in the subject area of Social Sciences and Humanities, with the entire editorial process being conducted electronically; this involved five authors with no computer experience, reviewers and editors. The computer system used was Honeywell Multics.

In the Phase II, which is nearing its conclusion, the performance of the editorial system has been evaluated in terms of man-actions and concomitant errors were examined; some 4,500 man-actions were analyzed. In addition to this, the man-machine interface has been subjected to scrutiny in some detail. Also, the human information processing aspect of this kind of human activity was investigated. The five various journal formats are being subjected to reader's reaction: computer printout; letter-quality printout; COM; typeset, printed and bound copy

as well as output on the VDT screen. Finally, a brief cost comparison study is being attempted to put the viability of the above forms of scholarly publishing in some perspective.

The present paper touches upon some component parts of the above project. After defining the notion of Electronic publishing we examine the performance of the tested system and take a closer look at the human information processing involved in the editorial process.

2. ELECTRONIC PUBLISHING: DEFINITION

The term "Electronic Publishing" has been recently used to describe a wide variety of processes where the material to be published appears at one or more stages or all stages transformed into and processed in the electronic form. At the earliest it may assume electronic form at the moment when ideas to be conveyed have been conceived and it may remain in the electronic state all the way to the moment of delivery on the screen as e.g. in the case of an electronic journal stored in the computer, or Videotex pages presented on a TV monitor. Alternatively, the final product may be delivered to the consumer (reader) as a hard copy (e.g. an online search in a computer-stored data base) or as a microfilm or microfiche (COM); other output is possible as e.g. voice or braille, etc. The distributed product need not necessarily be an end product as e.g. magnetic computer tape containing an issue of a journal for use by different users as either an update to a data base or an input into typesetting. And there are many ways to obtain a hard copy from the originally electronic "copy".

In the context of this paper, we are concerned with the editorial part of the electronic publishing process with special emphasis on the process of scholarly publishing activities.

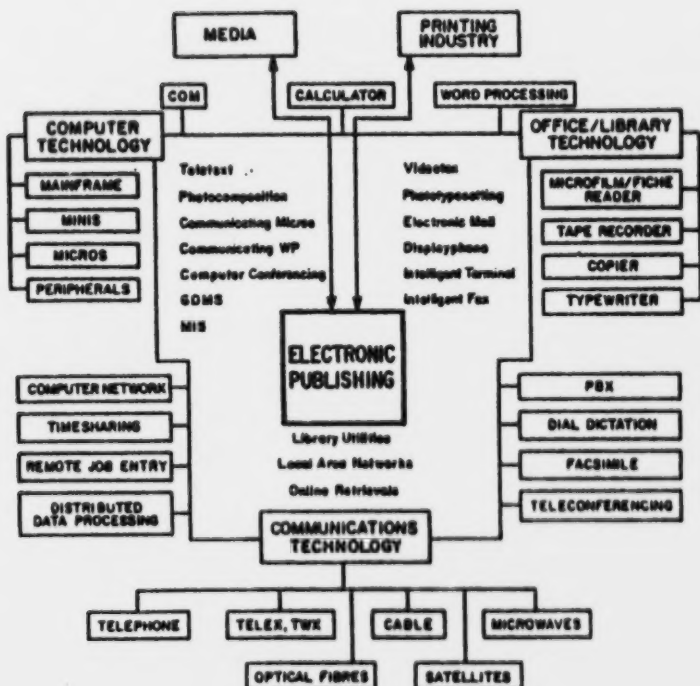


Figure 1- THE POSITION OF ELECTRONIC PUBLISHING.

Fig. 1 helps identify the position of Electronic Publishing as it evolved in the wake of the Conventional Publishing from the converging computer technology, communications technology and office/library technology with direct relationship to media and the printing industry. 3.

PERFORMANCE EVALUATION

3.1 DEFINITIONS

The Performance in our context is one of different measures of a system which tells us how the system meets the expectations (objectives, demands) we placed on it when we selected it for our project. It is also called effectiveness.

The term "system" in the narrower sense denotes the Multics computer system including the software, in the broader sense it encompasses the working environment, terminal, printer, tools etc, and the participants themselves as is required by the man-machine interaction concept under investigation.

As the source of our evaluation served the terminal printout which we have been gathering throughout the entire trial. All in all 4,497 actions were evaluated.

Man-actions in the context of our Report represent man-actions not including login/logout procedures because these are specified on the blackboard for user reference and are not expected to result in errors. Carriage return is not included either because of its routine nature. Actions in our context are one of the following:

1. Multics commands
2. Qx-Editor requests
3. Electronic mail commands
4. Answers which initiate further computer action.

In our interactive processes we are, therefore, concerned with:

- a) primary actions, in which man exercises his initiative, and
- b) secondary actions, in which man reacts to a machine action.

The actions that our users have taken (authors, referees, editor) in this Project were effected in the course of:

- 1. learning how to operate,
- 2. improving their skills,
- 3. writing and editing their papers,
- 4. refereeing
- 5. acting as editor
- 6. the concomittant messaging.

All actions center around the objective of generating an "electronic" journal encompassing ten papers in the subject areas of Social Sciences and Humanities.

3.2 EVALUATION CRITERIA

We have examined the interface protocol using a number of criteria and in this paper we will report on the following ones:

- 1. Comprehension and Random Errors
- 2. Total Errors
- 3. Errors Caused by abstraction

An analysis of errors and failures has proven to be a useful means in evaluating the performance of a system or in comparing two or more systems [1]. For our purpose here, we have defined errors as those actions in the man/machine interaction which exceed the computer's tolerance in a particular instance of performing an intended task. The man has an idea of what he wants accomplished (albeit a not well-defined one at times) and he wields his human information processing capabilities

plus a more or less complete knowledge of the computer system; the computer on the other hand, can perform in the cooperative task-solving activity only if certain strict rules are observed; an error results if these two capacities do not match each other and typically an error message or warning is posted by the computer.

3.21 COMPREHENSION AND RANDOM ERRORS

Comprehension Errors are those due to the lack of knowledge of how to achieve a given intended goal through the operation of the system; this may be caused by lack of or misunderstanding of instructions or simply because the user has tried unsuccessfully something on his own.

Random Errors are those made while the user most likely knew the correct course of action to be taken but failed nevertheless to perform properly because of insufficient attention, fatigue, slip of memory or impatience.

Both comprehension and random errors are unacceptable to the computer (exceed its tolerance for a given error) and as such require corrective man-actions to carry on the dialog. Because they are errors presented by the system to the user, does not necessarily mean they are the user's fault; in fact, in most cases they attest to the inadequacy of the computer system.

Types which have been discovered and rectified by the user himself are not included. Not included are "hidden" errors which do not result in error messages and do not interrupt the interaction; if they escape user's attention the computer is either doing something else than the user wanted, or the desired function is being done but the results will be erroneous. This kind of error is more difficult to detect because it involves conjectures about the user's intentions.

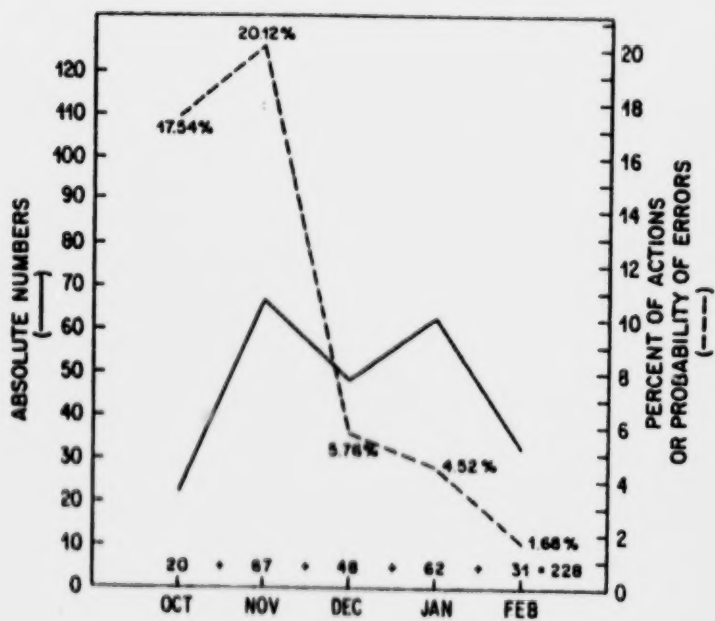


Figure 2' COMPREHENSION ERRORS (CE)

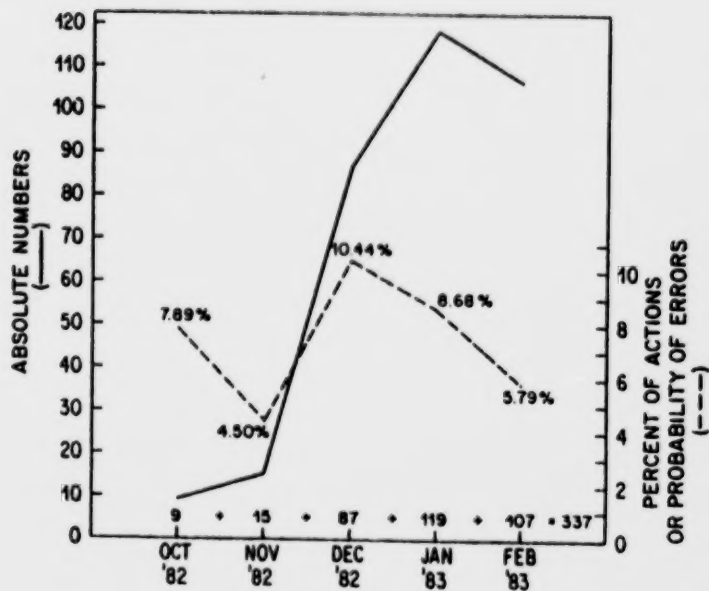


Figure 3 RANDOM ERRORS (RE)

Comprehension errors (CE) have been determined and plotted in Fig. 2. The number of comprehension errors shown in October, 1982 is 20; in November, 67; in December, 48; in January, 62 and in February, 31. More illuminating than absolute numbers is the graph of comprehension errors as percent of actions in all months under investigation: except for October data which are based on a small number of actions, the downward trend is clearly apparent: October, 17.54%; November, 20.12%; December, 5.76%; January, 4.52%; February, 1.68%. These figures, by their nature, state what probability of a comprehension error there is when a user takes an action. This graph is indicative of the pace at which participants on the project learned to use the system.

The level of comprehension errors attained by the end of the trial (1.68%) supports a practically flawless operation. There will be always a few comprehension errors attending introduction of new features or trying those which were considered difficult for a beginner.

Random errors (RE) (Fig. 3) kept increasing with the growing number of actions up until February when they showed a slight decrease. There were 9 RE's in October, 15 in November, 87 in December, 119 in January and 107 in February. Again, the real situation is better illustrated by expressing RE as percent of man-actions in the months respective: 7.89% in October, 4.5% in November, 10.44% in December, 8.68% in January, 5.79% in February. These figures also indicate the probability of a RE occurring when undertaking an action. They fluctuate within a relatively narrow margin of 5.94% (4.50 to 10.44%) which demonstrates their relative consistency with a visible downward trend toward the end of the trial. This shows that when the authors become more acquainted with the system (as demonstrated on comprehension errors above), they concentrate more on

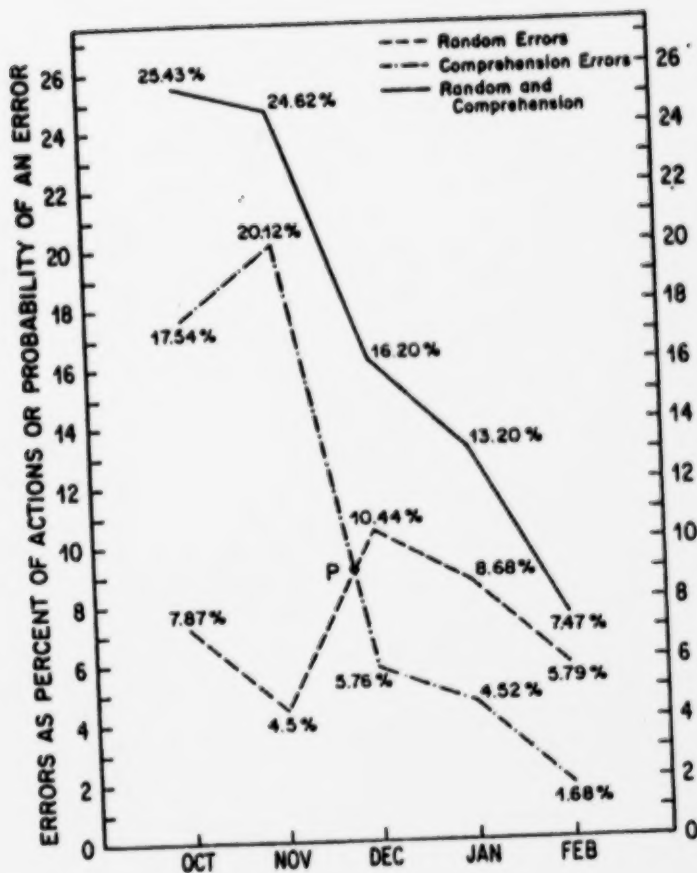


Figure 4 PROBABILITY OF ERRORS

"doing it right" rather than on the "how to do it" aspect; in other words, they feel more at ease, the frustration and impatience is less. At this point, their cognitive resources are freed from the learning aspect and focused on performing the task.

It appears as a result of this trial that if RE values fluctuate between 4 and 10 percent on the average, both of these extreme levels signify the difference between a good and bad performance respectively. Random errors cannot be completely eliminated because their causes are in the uncontrolled cognitive or in the emotional sphere, or they are altogether unexplainable; their number can be partly reduced by observing users, offering consultation and removing potential sources on a preventive basis.

3.22 TOTAL ERRORS

Fig. 4 summarises both CE and RE as well as their total and as such it is the most important indicator of performance. It eliminates the inherent element of a certain degree of fuzziness in marking errors as CE or RE in retrospect. It depicts the general and steady decrease in the number of total errors in the respective months expressed as percent of actions, which gives also the probability of an error when an action is taken: October, 25.43%; November, 24.62%; December, 16.20%; January, 13.20% and February, 7.47%. The same Figure shows something we may call the "shears effect" exhibited by the CE and RE graphs intersecting at point P which may be designated as a pivot; since the rate of comprehension errors will be, as a rule, higher in the beginning than that of random errors a point is bound to come where the CE will cross the more inert RE graph. In our case, this happened in the latter part of November. An ideal "shears effect" would be represented in a graph which

would be flat with CE not far above RE indicating an easy to learn system, one not too high above the abscissa and pointing downward; the smaller the 'x' coordinate of the point of P the easier it is to learn the system in terms of time required. The shape in detail of "shears" may, of course, vary to a large degree in different situations. Easy learning implies also an easy recall in later practical usage.

Our "total errors graph" displays a very favorable tendency which reflects the progressive improvement in the errors/actions ratio and indicates that there was no serious problem, at any point, as regards hardware, software or lifeware. It would appear that at the level of around 7% "total errors" do not unduly disconcert users, neither do they present any problem in achieving the projected goals; this was confirmed by observing users and querying them. The degree of user satisfaction and acceptance hinges then on "user-friendly" error messages and simple correction procedures.

3.23 ERRORS CAUSED BY ABSTRACTION

Up to now, computer applications have required a considerable degree of abstract thinking on the part of the users. Abstraction may refer to both tangible objects (e.g. storage, file, scratchpad, etc.) as well as intangible concepts (modes, modules, levels, commands, etc.). Computerizing conventional operations has required both uninitiated novices and expert users alike to deal with both tangible objects as well as intangible concepts as abstract notions existing on the one hand in electronic form in the computer sphere and on the other hand, in the user's mind as abstract constructs; it is up to the user to apply his cognitive system to cope with this problem. Some computer systems are more helpful than others in this respect. The problem arising out of

situations involving a great deal of abstraction is that users, instead of being able to concentrate on solving their particular problems, have to devote their human information processing resources to the struggle, not co-operation, with the computer interface. "Abstract" refers in our case to spatial considerations but it can conceivably be related to time, logic, operation sequence, etc.

Abstract thinking in our present argument denotes user's human information processing which lacks physical parameters of concrete objects and requires a great deal of imagination and memory if it is not helped by a suitable (user-friendly) system design; spatial factors play a major role. We have defined e.g. three major areas in our projects where users were prone to err very often:

- 1) While "reading" and "writing" between the working area and storage,
- 2) While moving between the command level, Edit mode and Input mode,
- 3) In using the "Cut and Paste" feature involving moves between buffers.

All of the above instances have one thing in common: they work with abstract entities devoid of any physical parameters such as shape, size, color, place in space, etc.; and exist only in electronic form and in user's mind. They can be learned even by casual users but they are easily forgotten and they burden the memory, both short and long, when it is needed most for problem solving and decision making. To eliminate this problem we would have to do three things:

- 1) to turn the abstract notions into concrete entities by assigning them names which are familiar to the user,

USAGE OF THE "CUT-AND-PASTE" FEATURE
(SPATIAL FACTORS INVOLVED)

USERS	NUMBER OF ATTEMPTS (X + Y)	MONTH	SUCCESS- FUL ATTEMPTS (X)	UNSUCCESS- FUL ATTEMPTS (Y)	NUMBER OF ACTIONS IN ATTEMPTS	FAILURES (SEE NOTES BELOW)
USER A	4	OCT. 82	1	0	28	+, *
		JAN. 83	1	0	17	*
		FEB. 83	1	0	31	+, *
		FEB. 83	1	0	9	0
USER B	1	NOV. 82	0	1	15	+, *
USER E	0	--	0	0	0	0
TOTAL	5	--	4	1	100	--
NOTES: + = LACK OF SPATIAL ORIENTATION * = IMPROPER SPATIAL MANIPULATION						

FIGURE 5

- 2) give them some physical appearance which is easy to draw and easy to recognize,
- 3) make these objects mobile so their physical motion can assist in the formulation of as many commands as possible thereby freeing user's memory for problem solving.

We have been missing interface features of some new systems as e.g. mouse, icons, in conjunction with menus, and also the split screen with forward and backward scrolling as implemented e.g. in Xerox's Star and Apple Lisa.

To illustrate the case in point, we singled out the "Cut-and Paste" feature and took a closer look at it. We examined its usage by all three users working at the central facility for the five months of our trial (Fig. 5). A typical successful operation would include the following steps:

- 1) Move a certain number of lines to another buffer and assign a name to it (the "Cut" operation),
- 2) Option: Transfer to the created buffer to verify status,
- 3) Option: Make changes to the "cut" portion of the text,
- 4) Option: Transfer back to the main buffer,
- 5) Point to where you want the "paste" done: define the line and select "append", "insert" or "change",
- 6) "Paste" the "Cut" section to the spot defined by moving it from the created buffer,
- 7) Option: Check the result for accuracy.

The "Cut-and-Paste" facility is obviously of considerable importance to any author, referee and editor in entering and editing papers. It was, therefore, with some surprise that we found the very limited usage of this facility despite the special attention we paid to it in our training programme, the pictorial posters placed right close to the workstation, the documentation dispensed to users and the consultation available to them. Out of 4,497 man-actions undertaken by users within the framework of our project, there were only as few as 100 actions related to "cut-and paste" (2.22%). User E, who has not achieved a satisfactory degree of performance, has not used this feature at all; whereas User B only once and unsuccessfully; User A availed himself four times of the "cut-and-paste" and each time he succeeded eventually (Fig. 13). We monitored the failures which users sustained during their attempts and found invariably that they can be attributed (1) to the lack of spatial orientation where the user loses track of in which buffer he is, and (2) to the improper spatial manipulation of the text involved. In these five reported attempts (both successful and unsuccessful) users employed a total of 100 actions; as outlined above three to seven actions per attempt could have accomplished the desired objective, in other words, 15 - 35 actions only were required. The case of the "Cut-and-Paste" is yet another proof of the plight of the casual user: User A accomplished his task with 9 actions in February whereas prior to that he needed 25.3 actions on average; even if there were any of the above actions expended as part of training or a "warm-up" that would bear witness to the need of an occasional user to spend time practising these "spatially oriented" features when an occasion for their application arises.

But the main message of the statistics in Fig. 5 is to show that users, and particularly casual users, shun features which by their abstract nature engage their cognitive resources when they need them most in the pursuit of their tasks. Users try to circumvent these features and replace them with other, simpler ones even though they may be tedious. It is all the more interesting in the light of the fact that our editing system does have a simple command whereby a user can ascertain which buffers are currently in existence and which one is his "active" buffer. Other features can be programmed, but users will still struggle with these expedients if their usage of the system is an occasional one.

4. HUMAN INFORMATION PROCESSING

4.1 INTRODUCTION

Cognitive factors in human interaction with computers have received more attention lately (see e.g. [2]).

Human information processing during the editorial process of scholarly publishing has been subject to drastic changes due to the process becoming more and more computerized. The longhand product has remained intact if we ignore some auxiliary means of providing information such as e.g. the author obtaining online information to verify his views or receiving statistical analysis from the computer center etc. Basically the traditional human information processing is applied to prepare a manuscript although the author has additional external (computer) memory and processing at his disposal; the knowledge required for this job has to be stored in his/her memory and must be recalled from the memory when required.

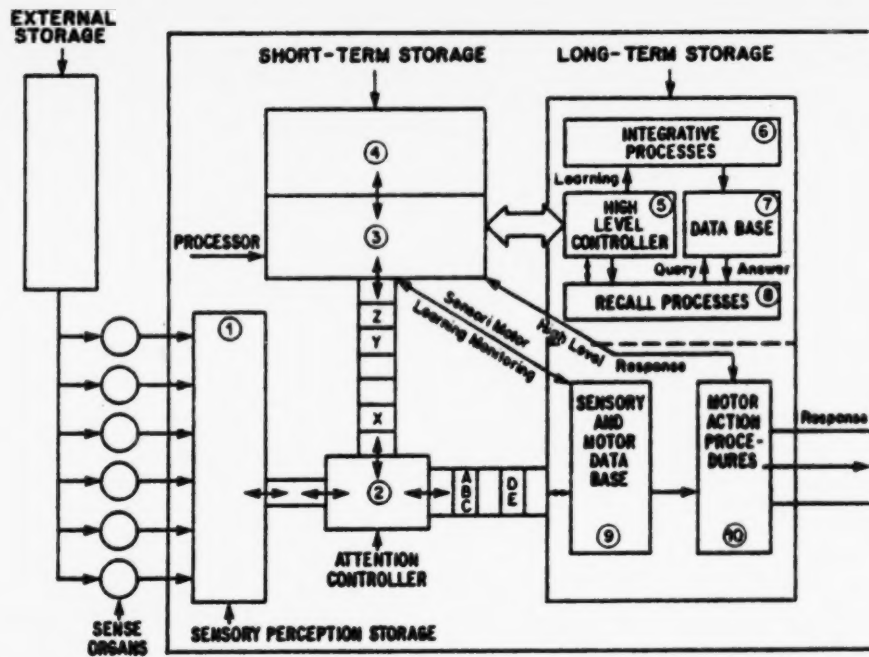


Figure 6 - MODEL OF HUMAN INFORMATION PROCESSING.

Our main concern in this section is the human information processing that follows the production of the manuscript. It will take sometime before the traditional notepad and pencil will be replaced by an electronic equipment of equal convenience even though the technology for this is around the corner.

In this section we will exploit the achievements of cognitive psychology which evolved under the catalysis of the computer science in general, computational linguistics, artificial intelligence, human factors engineering and information theory. We will first describe the model used to explain selected phenomena observed in our trial.

4.2 THE MODEL

The model outlined in Fig. 6 has been designed to account for the human actions on the man-machine interface in our project although it may be applied to a wide variety of situations; it is only as detailed as requisite for our purpose. Similar models have been proposed in the literature [3,4,5].

According to this model information perceived by human sense organs and stored for a short period of time in the Sensory Perception Storage SPS (box 1) is directed by the Attention Controller (box 2) for high-level processing (involving logic, arithmetic, etc.) to the Processor (box 3) with the associated Short-Term Storage STS (box 4). For long-term storage it is integrated by Integrative Processes (box 6) into the Data Base (box 7). The High-Level Controller (box 5) routes queries to the Data Base and back to the Processor. This kind of processing may be characterized as "one-for-one" in other words one unit of output for one set of input data; it is process-intensive and too much data will have adverse effect on the quality or speed of processing.

This is where non-routine tasks are being solved by conscious operations; multiple or complex tasks will have to be resolved sequentially since this processor is a serial one where the channel is switched between tasks and partial stored results as needed depending on the capacity of the individual, his background. It must be stressed that most of the links connecting the above components are two-way channels allowing for simultaneous bidirectional traffic; this enables operations such as learning, retrieval, feedback, evaluation, input, output, monitoring, control, etc. to be combined and/or separated in either or both directions in a kind of "full-duplex" mode.

If a routine task is being performed the low-level processing route is selected which is characterized as "many-for-one" type which denotes an operation where a number of motor actions may be triggered at the same time in response to one sensory stimulus. Whereas the above described mode involved the intellect, the low-level processing may be designated as automatic. Several actions may be taken as a result of parallel processing: sensory perceptions arriving from the SPS (box 1) and the Attention Controller (box 2) are passed on to Sensory Motor Data Base where they are matched with corresponding images created there by sensorimotor learning (training) and translated into actions in Motor Actions Procedures (box 10).

The above components are described in some more detail below: their interaction and cooperation must be viewed in a highly dynamic manner.

4.3 TOOLS AND PROCEDURES

There is a fairly general agreement that at the front end of our cognitive system is a buffer which is called by different names e.g. [4] Sensory Information Store, [5] Very-Short-Term-Memory. We call it

Sensory Perception Store (SPS). This memory stores information (images, events) as they are received through our sense organs and has very short duration (approx. 250 m sec) whereupon it dissipates. In our instance, an author who is editing his paper uses this memory constantly as he watches the VDT screen and/or his manuscript; rarely does his auditory system get engaged as e.g. through the bell at end of line. The short period of time the information is stored helps the pattern recognition processes to interpret the information at subsequent stages. But first the information must be selected from the redundancy that sensory organs provide; from that follows that there should be always only a limited amount of information presented, especially to an untrained user.

The pattern recognition processes could be aided by some expedients which would help in sorting the perceived information as to categories or priorities and would also assist with learning. E.g. warnings of critical nature might be given in voice, graphics could help understanding and color might focus attention. We had in our trial none of these at our disposal but there is no doubt that they will have a secured place in man-machine interfaces of the future. They must be used judiciously though lest the effect might be negative.

In the light of the overwhelming amount of information the user encounters on the screen and elsewhere in the working environment, the effort must be aimed at presenting him with a reasonable amount of information at a time and make the information easy to recognize by pattern recognition processes which bring it to the next stage of the cognitive system. If we tie up too many user's information processing resources at the pattern recognition stage, we are bound to impoverish his other processing aspects.

After the sensory perception storage there is another memory buffer which has been named Short-Term Memory (STM) or Storage (STS). This buffer remembers the interpretation of images or events which were picked out by pattern recognition process from the SPS. STS has a small capacity (7±2 "chunks" of information) and decay time of 10-30 sec. unless information is rehearsed. In the STS information is interpreted, encoded for permanent storage further down the cognition path. STS is sometimes considered as an independent unit [5], or as part of "a higher-level conscious processor" [3] or more than one special-purpose processors are regarded as "neglected but more biologically appealing ideas" [6]; but what matters for our discourse is that its existence has been experimentally proven and it fits into our model. It is important to realize that STS has both the memory (albeit restricted) and processing functions.

The STS can work both in the bottom-up direction (data-driven processing) and top-down direction (conceptually driven processing). An example of the former on our type of interface is a situation where the author has perceived an error message through his/her SPS, decodes it through pattern recognition processes, and formulates a strategy in the STS; and example of the latter is the decision conceived by the author to send a message which is then translated into practical procedure followed by an action.

Another salient property of the STS is that due to its low holding capacity at any given moment, it can only attend to one task at a time, being able to switch from task to task alternately. The STS with the associated processor is called to task whenever non-routine processing is being called for. Electronic scholarly publishing is a mixture of

routine and skilled routine tasks (with different degree of skill) with intellectual non-routine tasks. Non-routine tasks are absolutely prevalent in the actual creation of a unit of scholarly publication where logic manipulation, arithmetic calculation, problem solving and memory interpretation, etc. abound. In the subsequent text entry there are functions which require skill, as e.g. editing and formatting but once the skill has been acquired the cognitive procedures are automated to a degree depending on the amount of skill which, in its turn, is affected by the amount of training and practice. Whenever the routine processing is in trouble as indicated by external data (error message or unfamiliar situation e.g.) the non-routine processing will take over based on the sequential (serial) processor of the STS replacing the routine mode of the sensorimotor system. The interesting point here is that this single channel operation might effectively result in only replacing one routine (e.g. our author entering text) by another routine selected from the store of various routine procedures (e.g. replacing a character or substituting a word); this in fact, is very often the case in our particular application.

Long-Term Memory (LTM) or Storage (LTS) is the most complex memory system of large capacity (around 100 billion neurons) and long duration: some information is kept for all life depending on the depth of integrative efforts. LTS is the storehouse of information (or the data-base in another jargon) and is associated with concepts like memory, remembrance, thinking. More important than acquiring and storing information is its recall function which is only as efficient as the interpretative processes on the actual data base.

From these characteristics of the LTS it is evident how important training is in the context of the man/machine interface. Retention of the presented material may be helped by a better integration into the existing knowledge: this can be only done by building deep semantic associations. The posters we have used in our training assisted our authors in creating their own mental images (of course they were also instrumental in the process of understanding which is an STS-related phenomenon).

Using icons in an interface turns process of recall into one of recognition and that makes the process of issuing a command easier. Retrieval should always be facilitated because it frees resources which otherwise would have to be shared with view to the single-channel operation; selecting from a menu has the same recognition/recall effect and a properly designed graphic (icon) representation should have an edge on the textual form of the menu.

We cannot think of problem solving tasks being resolved by a straight forward SPS-ST5-LTS action. Rather, there are bursts of interaction between these units moving back and forth. If we take as an example the activity around the "substitute" feature of our editor program, then the SPS presents the text, ST5 interprets it, then the mistake must be detected by checking the LTS data base, the correcting procedure will be loaded by supervisor into the ST5 which will execute it step by step in close cooperation with both the LTS and SPS.

It is evident that for our model to be functional the LTS must be equipped with a controller (High-Level Controller) to control the complex operations on a vast data base of data and procedures.

Even though not anatomically part of the human information system, the external storage (ES) is an indispensable component of it. As a matter of fact nothing that can be efficiently kept in the ES should be burdening the LTS. A glaring example are the login/logout procedures which should be kept handy for an easy referral. This is reinforced by the fact that forgetting obsolete information is less manageable than learning amendments and updates.

Sensorimotor Control provides the link between the sensory perceptions and actions which result from them. It is a significant part of the LTS but it is not clear how autonomous it is. If we designate information processing taking place in the STS's processor as "high-level" because it involves a great amount of sophisticated processing in response to even a small amount of information from the SPS and possibly very little output, then the sensorimotor control system may be designated as "low-level" implying a small amount of processing with possibly a great deal of output. An example of high-level processing in our instance is working on a relatively unfamiliar task which requires a reviewer to recall information and to employ non-routine procedures in reviewing a paper. An example of low-level processing is entering one's own text by keying it in where the author is skilled in typing and uses a familiar editor program. It follows that the same activity which is initially unfamiliar and requires non-routine high-level processing (e.g. electronic mail used to link users with their Editor-in-chief) turns gradually into a familiar skilled routine activity entailing low-level processes. Obviously some kind of attention controller as suggested in our model is called for to arrange for immediate switching between these two states, the low-level processing being the default state.

Simultaneous high-level and low-level processing can materialize and in fact is often happening as e.g. an author thinking about a subject-matter related problem while entering his paper.

We have not included emotional aspects of human information processing in our model; they are one of the more controversial issues in the cognitive psychology but they seem to be close to the sensorimotor sub-system. We have noticed on several occasions in our project that users baffled by some unforeseen events displayed symptoms of panic, abandoned rational procedures of high-level processing and unsuccessfully used short-cuts in their attempt to solve the problem.

Sensorimotor processing allows humans to increase productivity with less effort than would be otherwise expended by high-level processing.

4.4 GENERAL OBSERVATIONS

The notion of fatigue is an important aspect of human information processing much the same as in other areas of human endeavor where economy of man's effort matters. In the light of the above low-level/high-level processing dichotomy it may be said that most tiring are operations which involve a great deal of "time-sharing" type of tasks where the single-channel of the serial high-level processor is switched between tasks which have to be attended simultaneously. An example of this situation is an author creating his paper on the screen from a few cursory notes on paper, struggling with an unfamiliar editor program when suddenly a message arriving in real time begins appearing on the VDU which requires a consultation with the manual. On the other side of the spectrum, the pure sensorimotor operations will consume only a fragment of the energy expended in the previously cited case.

In a previous section dealing with errors we distinguished between the comprehension errors (CE) and random errors (RE); it is appropriate to state that CE's have their roots in the high-level processing sphere at the stage of learning and are due to improper or inadequate chunking (encoding and integration) in the LTS. In this context the plight of the occasional user is viewed from yet another angle: it is a user who cannot (because of infrequent usage) permanently encode the semantics of a system to a depth that would lend itself to a process of pattern recognition or to that of recall; the rehearsal would only improve understanding but not retention. The RE's stem from lack of attention, fatigue, panic, etc. and these may disrupt processing at either high or low level.

It is imperative that principles of a computer system should be taught first and details later; this is because the integrative learning processes try to accommodate newly acquired concepts into associations with the existing ones; if there is nothing they could be associated with then the process of generalizing would have to be started from the more specific items to the more generic terms; this is more demanding than building associations "top-down" and involves an additional process of induction. The mental model users create of a system [7] may be a wrong one.

It has been also noted that users do not like changing from one medium to another: this can be explained in terms of the processing load associated with such a move. First, there must be an exigency calling for the present activity to be interrupted. The current results must be stored so they do not get lost. Second, the alternative solutions must be brought from LTS into the STS and evaluated as to their suitability.

Third, the selected procedure must be loaded from the LTS: this may include a number of subroutines involving hardware and software which may have to be recalled, reviewed or even learned. The humans instinctively shun complexity and this situation may lead to a near overload; this is a glaring example of a conceptually driven operation. The situation is complicated even more when data start arriving from the environment calling for immediate attention resulting in more interrupts. It is much easier to be able to obtain assistance on the familiar hardware and software.

5. CONCLUSIONS

On the basis of the description of principles of the human information processing we may conclude that a good ("user friendly") man-machine interface is one which does not take advantage of the indisputable flexibility and adaptability of the human part in this cooperative arrangement but, on the contrary, exploits the immense capabilities of the computer system to become an extension of human processing.

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Recent work of the IEPRC

H a n s E h l e r s
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Before I begin with my presentation, I'll better explain the acronym IEPRC: International Electronic Publishing Research Centre. It is an independent non-profit organization engaged in research into all aspects of electronic publishing. It began its work in 1981.

Why centre and not institute? I feel that 'centre' describes better what we would like to have, a place where persons - not organizations - can meet, share knowledge, do in a regulated way what a symposium tries to do in a day or two. At IEPRC we rely in our research on experienced professionals in publishing and new media technology.

The pail shown on the slide is as unsuitable for scooping water as a research institute is a topic for visualisation. To avoid dull gaps in the presentation, I chose recent examples of 'Computer Graphics', a topic with a high priority on the IEPRC future-project-list. Most of them I picked up at a recent conference in Chicago (NCGA '83) where I was invited to give a paper on presentation graphics.

Gordon Graham, IEPRC chairman and chief executive of Butterworth & Co. London, is a good example. As he was the man who introduced me to electronic publishing, it might be fitting if I start my survey of recent work of IEPRC with some quotes from an article 'Adversaries or allies' by Gordon Graham in the July 1983 issue of 'Scholarly Publishing'/Toronto: "New technologies, electronic publishing, etc. are impelling publishers and librarians together, as we see it at this symposium, because they are blurring their traditional roles. Publishers believe that the day the first librarian issued the first photocopy, librarians embarked on the publishing business, and librarians apprehend that the day the first publisher set up the first full-text database, publishers began to usurp the historic role of the library".

This switch in roles should be seen as symptoms, not substance. "One of the insights which publishers and librarians give each other, is that neither profession is monolithic (which is a

weakness in face of the new technology). New technologies, electronic publishing tend to harmonize ... Publishers and librarians face the same basic challenge: the user is changing habits ... The photocopier has made every man his own printer. A database user can search for the information he needs electronically and be his own librarian. When he locates on the screen what he is seeking, he can punch a print-out button and be his own publisher." Gordon Graham closes his address: "The signals for librarians and publishers are the same - to open new doors as old doors close." IEPRC wants to help to make this door opening easier and to understand what is visible in the room we are about to enter.

There are many definitions of electronic publishing. In IEPRC we use it to describe the application of computers to the retrieval and dissemination of information in all its forms. The IEPRC provides an international forum for exchange of research ideas and electronic publishing know-how.

Research projects cover technical, economical and especially marketing aspects of electronic publishing systems, including computer hard- and software, text preparation and editing devices, graphics input components and output visualization.

IEPRC evaluates systems, software and equipment and monitors the introduction and application of new technologies. It is also active in producer/user interface studies and sees the importance of personnel training through seminars, conferences and study tours.

IEPRC is funded by voluntary contributions of its members. Membership is possible for private and public organizations engaged in publishing and companies active in printing and production of published material; producers of hard- and software used in the publishing process and finally suppliers of material and services to the publishing sector.

IEPRC's work is carried out for its international membership by a permanent staff and research laboratory facilities of

Pira (the research association for the paper and board, printing and packaging industries). IEPRC is registered in the UK at Pira House, Randalls Road, Leatherhead/Surrey. It has its own board of directors, with Gordon Graham of Butterworth as chairman. Chief executive of IEPRC is Brian Blunden, director of Pira; the finance committee is chaired by Jean-Manuel Bourgois, president of Bordas Dunot Gauthier-Villars; I have the honour to be chairman of the research committee.

In the library field the keyword 'research' has a long tradition. But if we look into the indexes of some standard works about publishing and printing, we find a lot of research mentioned about paper, ink, printing, etc., but almost nothing about 'research' covering the essential functions of publishing.

If we include the international aspect of IEPRC, we had to my knowledge only some activities in the early sixties. Book Market Research was the keyword then, four conferences were held: 1963 Amsterdam, 1965 Paris, 1966 Berlin - the international need for a standard book number, the ISBN, was initiated at the Berlin meeting where I had the privilege to read a research paper on numbering systems; Great Britain also hosted one conference which took place in March 1968 in London.

However these research activities did not stir up a noticeable group of publishers. Publishing remained a job for gentlemen, an 'accidental profession' as it was called in the USA. When only a few publishers added, in the late seventies, 'electronic' to a still relatively very small part of their activities, some of them felt that it was time to have more professionalism, more information, more independent thinking, more research about the essential function of a publisher - as selector, packager and distributor of information. We need research, in-house and from outside, in order to understand better the new media. If we like it or not, in the library field, in printing and publishing, technology is a major element. Companies and organizations are increasingly aware that the impact

of new technologies cannot be left to a small group of junior R + D persons. A greater degree of involvement is required. Publishers need research to package successfully, to find the most suitable format and the most efficient mix for their products and services. More than ever there is a need for market research to sell what is offered to a market with diminishing resources.

Up to now it still is a relatively small group who are not folding their hands to await things to come, but are already active in electronic publishing: Random House, McGraw-Hill, Wiley, Scott Foresman, Grolier, Dow Jones, Dunn & Bradstreet in the USA. In Europe where the IEPRC has still most of its members, the best known firms are Academic Press, Bordas, Butterworth, Esselte, GID, HMSO, Klett, Larousse, Longman, Mondadori, Oxford University Press, Pergamon, Readers Digest, Samsom, Thieme, Ueberreuther, VNU. In this list I purposely left out the country of the firms mentioned; a couple of them are active in many countries.

The publishing and printing industry has indeed become international. This is nothing remarkable for the English speaking world, but it is new for other countries. Research in publishing with a national bias is bound to fail, electronic publishing started world-wide from its early stages.

What kind of research do we need, what kind of research does the IEPRC hope to offer? What can we do to prevent that the wheel is not reinvented constantly?

All researchers would prefer to work for pure science, to study for example information transfer, or other communication models, artificial intelligence, and similar topics, but for the IEPRC with its limited funds only 'applied' research is possible. Especially in times of cutbacks and economising, we only have a chance to continue our research when we are result-orientated. Negative proofs are also results, often more valuable than far-fetched positive ones. When we discuss priorities in the Research Committee, we try to give preference to pro-

jects that are most likely to bring results soon, results that are easily transferable to our members.

Research, especially in electronics and communication, has tended to erect a barrier around its work. Some of us experts have the habit to throw up a cloud of fashionable buzzwords or technological jargon so that very often their ideas and findings, as valuable as they may be, are screened from the view of the uninitiated. At IEPRC we want to avoid these barriers, we regard the centre as a forum, as a place where practitioners talk to each other in a language each could understand.

We don't need to crow about, but we live in a recession. In many countries the market is diminishing due to a lot of reasons, but especially because of the falling birthrates. Well-managed companies outside publishing are reappraising and restructuring their research efforts. Only in relatively few firms in publishing, research is treated as an integral part of the companies' mainstream activities. Research needs teamwork, inter-disciplinary management and enthusiastic experts that are able to work across old established lines. We need people that are not only innovative but understand the market. Too many examples are known where researchers withdraw into their ivory towers, or outside research results were rejected by the in-house expert because of the 'not-invented-here' syndrome.

Publishing now has not yet a tradition in research. We all can quote flops where market or users acceptance research (or what ever one liked to call this forecasting routine) had promised success. True, failures are talked about, planned successes are taken for granted. There is another reason. Research has tended everywhere to overvalue abstract analysis. Findings that could not explain everything in detail, parameters which could not be quantified, were not accepted. Black boxes, irrational behaviour, short-living fashions, etc. did not seem to exist. Some publishers, but also librarians seasoned in business, believe they do not need research; it is supposed to be

too expensive. What one liked to have should be a recipe for what to do when and what not to do. But this is not the format in which research results are normally presented. Nobody in consulting or research can write out recipes. What we hope to get from research are not only short or long-term perspectives, we need new ways to see and evaluate facts, situations and future developments.

I do not pretend that all research efforts of the IEPRC give these new perspectives. Maybe they are there, but we failed to communicate them properly. A danger I am well aware of when I'll attempt in the next chapter to introduce some of the research projects the IEPRC has undertaken. On the one hand it is difficult to present something objectively in which one was deeply involved. Also if one tries to cut away all the flesh, only unpalatable bones remain. Finally, there are the personal likes and dislikes.

Project DELPHI

The Delphi Study, the results of which were introduced at the second research conference of IEPRC (25/26th May 1983), was one of the first projects started. The research committee and the IEPRC staff (Yuri Gates, project leader, Jon Maslin and Bevin Gowan) felt that the Delphi forecasting technique was the most suitable one, as in the new and complex area of electronic publishing predictions based on trend extrapolations would be impossible.

From the very beginning IEPRC was able to rely on the expertise of men and women who helped to make electronic publishing a reality. So it was relatively easy to gather about 50 participants for the two main Delphi rounds. The experts came from all parts of the world. It is very likely that they were able to assess correctly which technologies are most likely to be successfully introduced into which market. I am only sceptical whether the Delphi group was qualified to identify factors which will affect the uptake of electronic publishing technologies. Anyone now active in electronic publishing and

New Media technology must be an optimist, and optimists are not the best to forecast new media acceptance.

The project Delphi attempts to forecast worldwide and continent by continent what will happen in electronic publishing from now until 1991. It hopes to identify markets, technologies and the time spans within which the various electronic publishing technologies will be introduced commercially and become profitably in different market sectors.

Forecasts were made for the following media/technology:

Broadcast Videotex
Interactive Videotex
Cable TV
Video Tape, Video Disc, Optical Disc
Personal Computers
Telecom Access to databases
Teletex.

The study considers the following broad markets: Education, finance and business, professional, scientific, technical, medical, consumer and leisure.

I will not try to summarize the finding. I think one sample will show better what the study tries to achieve:

Optical disc in further education.

In the glossary of terms optical disc is defined as "Device designed to store primarily video and sound information. It provides high density storage at a relatively low price and can be used with a program and computer or processor for random access". We would call it today: Intelligent Interactive Videodisc System.

The forecast gives for this aspect the following figures:
Worldwide (Europe in brackets)

Commercial introduction: Median 1989 (90)

Quartil range 88 - 90 (85 - 99)

Profitability: Median 1991 (91)
 Quartil range 90 - 91 (88 - 91).

Some of the additional comments might be of interest.

Germany: Interactive approach essential, also stereo /
 two languages. Combination with personal computer
 necessary for profitability.

USA: Implies interactive video disc. A pilot project in
 1980 proved feasibility.

Sweden: The video disc has unique features for educational
 purposes.

U.K.: Learning programs linked to microcomputers.

As Klett Publishing is one of the very few houses already
 active in this sector of electronic publishing and has pro-
 duced educational video discs (Laservision system) I think I
 can judge fairly well the result of this market segment fore-
 cast. I believe nobody could give a better estimation on com-
 mercial introduction and hoped-for profitability.

It is planned that IEPRC should update the forecast regularly
 by a single round. More IEPRC and other experts should join
 the panel.

Project SATSYS - Satellite Systems Study

This small-scale information gathering exercise was recommended
 by the IEPRC Research Committee at its meeting in London in
 September 1982. Satellite transmission of text and graphics is
 nothing very new. Dow Jones started digital transmission of
 facsimile material by satellite already in 1973. But especial-
 ly the success of 'USA Today', a general interest national
 daily newspaper, with a high percentage of colour graphics and
 illustrations, with the headline 'Via Satellite' under the
 title, made it obvious that this technique is here to stay.
 'USA Today' is printed at 16 different locations; text and
 colour pictures are transmitted by satellite communication.

Anyone active in new media technology and planning to participate in electronic publishing, has to study the essentials of transmission via satellite. The CEC and the European Space Agency will be cooperating in a test-bed project called Apollo. IEPRC plans to participate in this programme in which documents will be transmitted electronically via a satellite.

To be better prepared for this participation, the Satsys project was launched; within 8 months a study was available to IEPRC members, covering especially the Financial Times and Agfa-Gevaert satellite transmission experiments. To set these demonstration projects into context, a small-scale literature search on the Pira/IEPRC database was undertaken, resulting in a short description of the Time Colour Facsimile system. Copy from Time's New York office is relayed by an RCA satellite to San Francisco and forwarded via Intelsat IV over the Pacific to Hong Kong. Each page, halftone, colour positives, and text, are scanned with a resolution of 1,200 lines per inch. Other projects summarized in Satsys are Japanese experiments and the AIP project (a satellite experiment on database searching and document delivery by the American Institute of Physics).

The mentioned Financial Times and Agfa-Gevaert projects researched also by interviews etc., proved:

- o Satellite transmission of documents is technically feasible.
- o For documents delivery application, the existing facsimile transmitting equipment for newspapers, and magazine pages to remote printing plants is not suitable.
- o New telecopying machines and facsimile receivers have to be designed, but prototypes exist already.
- o The possibility of mixed mode transmission by satellite of text in the form of coded characters and pictures in the form of facsimiles, has not been explored in publishing applications.
- o Whilst there are other wide-band telecommunication systems, satellite transmission is more likely to be available for

tests during the next few years.

- o As there are sufficient unresearched aspects of electronic document delivery by satellite, IEPRC should continue to participate in practical experimental projects.

Project EPTECH

Eptech, the electronic publishing technical scenario (implications for book, newspaper and periodical publishers), is undoubtedly the most ambitious project IEPRC has begun. Dr. Rune Pettersson, responsible for New Media Development of Esselte/Sweden, member of the IEPRC research committee, is project officer. The project team is the same which was responsible for the Delphi Study. In May 1983 a first draft was circulated within the research conference attendees.

The scope and objectives of Eptech show the wide field the study will cover. The scenario will deal with:

- the evolution and enhancement of traditional products and
- the development of electronic products.

The scenarios are meant to describe the interaction between the important current and future media, technologies, products and services. Eptech hopes to produce well-balanced positive recommendations for practical experiments in the application of electronic publishing, either in the IEPRC or other research organizations.

There are 10 chapters covering communication models, media and representations. The 'Different media, current and near future' are dealt with. In another chapter we find live, graphical and sound media analyzed, models-, exhibitions and film media are as covered as broadcast, video and telecommunication media.

Chapter 4 analyses the different technologies, regarding input, data storage and transformation transmission and presentation. Another chapter outlines advantages and limitations of the

technology.

The characteristics of traditional publications and the development from product to service are dealt with in chapters 6 and 7. Implications for electronic products - here the market segments that were analyzed in the Delphi study - form the basis for various environment scenarios. The study ends with conclusions and recommendations.

Here again I do not intend to summarize the extensive study but take up one small item we have already mentioned in another context, the combinations of text, images and sound. Here we read in the draft Eptech report:

"Combinations of text, dynamic and still images, flat and three-dimensional images, sound and programming are of significance for the development of new products in electronic publishing.

The technology for each of these exists separately and is in use, and there are many examples where at least two are combined, sometimes in sophisticated ways.

A number of technologies offer significant opportunities for new means of design and creative production, e.g. holographic three-dimensional designs and 'sculpture'. Important applications are in the creation of games, as well as interactive educational and information packages. So far the pace has been set by games.

Currently many of the techniques are present, but the tools to help creators use them easily are lacking."

To identify significant technical, economic and market development in electronic publishing, three research studies were initiated by IEPRC.

EPTECH to study interaction of current and future technologies;
EPECON to analyze economic factors and cost benefits;
EPMARK to cover the market and related factors.

EPECON and EPMARK will also be completed in 1983. Understanding-

ly, these scenarios cannot be fully international. A UK-orientation is likely for both of them. That is the reason why they are not fully covered in my survey.

The IEPHC Research Fellowship Scheme

A non-profit international research organization as IEPHC strives to be, needs a nucleus of unbiased, capable and motivated researchers believing that the new technological developments will enhance, not endanger, the publishing trade.

To meet this need the IEPHC Fellowship Scheme was created. It hopes to make funds available to support M.Sc., M.Phil. or Ph.D. Research in electronic publishing. Funds will be sought through sponsorship or a fellowship. English-speaking students and university professors on leave are eligible from any country. Calls for Fellowship will be made through various channels, foremost to IEPHC members.

Sir Harry Hookway, Deputy Chairman and Chief Executive of the British Library, is chairman of the IEPHC Fellowship Board, other board members include the director of the Centre for information Science, City University London, the chief executive of IEPHC and the chairman of the Research Committee.

Electronic Publishing Abstracts

Another valuable service of IEPHC is EPA (Electronic Publishing Abstracts), an Online Database produced by Pira and IEPHC. The Pergamon group of companies is responsible for dissemination in printed form or online. Pira has been collecting material on electronic publishing since 1975.

Every month 200 journals - unfortunately about 80 % from English speaking countries only - are scanned and summarized by trained information scientists. The service covers

- o Economic and technological trends and social factors;
- o Copyright and data protection;
- o Methods of processing information input;
- o Communication media, including networks, facsimile transmission, electronic office, videotex, interfacing protocols

and standards;

- o Information storage (Magnetical, optical and holographic);
- o Retrieval Systems (databases, artificial intelligence, document delivery);
- o Output
(Hardcopy laser printing, image processing, computer graphics).

An advisory board has been set up to help identifying trend changes in subject areas, document coverage and new sources for information. In autumn it is planned to form a User Club to get opinions from users and to encourage information exchange. There will also be seminars to get better acquainted with the services offered, not only for bibliographic searches, but also for magnetic tape leasing and support services such as translations, photocopy, etc.

For non-members the bi-weekly current awareness printout costs £ 100 annually, online searching £ 35,-- per connect hour and 12p per off-line print.

Outlook

Publishers and librarians are being asked worldwide to redefine their work. Our belonging together to the growing membership of the information community is one step in this redefinition process. Everywhere there is a widening recognition of the importance of the role of information, in printing, publishing and the library field.

More or less, all of us here accept the challenges and opportunities presented by electronic publishing and the information technology and methods changes that go with it. I only want to mention the economic and legal problems arising from transborder data flows of information. Nobody will object when I say openly that so far no one - the members of IEPRC included - understands fully what happens in this industry and how users will react and adjust their practices to get a better information environment.

This uncertainty should not disturb us unduly. In conventional publishing there are quite likely not more than a dozen personalities that can claim to know what publishing really means. To understand the scope of 'media' quite well, it cannot be regarded as a subgroup like educational or STM publishing, but it must be seen as a whole in the field of electronic publishing.

To understand electronic publishing and the needed software, we must train the decision-makers, or better those who are willing to take responsibilities in the information community, to increase their computer literacy, as essential to a publisher or librarian as the ability to use languages proficiently. The microcomputer changed electronic publishing from an interesting sideline to an essential part of our job. I don't believe in an either/or. There will be books and electronic display devices for a long time to come. But we over-thirties have to hurry catching up with the younger generation, with our children.

We are witnessing in the introduction of the MC (or PC) in the States, but also in Europe, something that never happened before: It is the first educational and especially technological revolution that is being led by children, really youngsters, not young adults. They started the boom in graphics, they introduced the third dimension, etc.

Publishing, also in its electronic version, is - and will always be - a people business. IEPRC will do its utmost to help that it remains a trade or a profession, maybe even an industry where able people decide, where language and pictures are communicated, not just digits transmitted. We should all aim for growth markets. The worst we could do is to take a defensive, wait-and-see, knitting-as-we-always-did posture, often found with people and organizations who are mature and have centuries of tradition.

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Electronic publishing and records management

Marc D'Alleyrand

CBS Inc.

New York, New York

U.S.A.

author was not able to attend the symposium

ELECTRONIC PUBLISHING AND
RECORDS MANAGEMENT

By: Dr. Marc R. D'Alleyrand

CBS Inc.

New York, N.Y., U.S.A.

Note: In this paper, electronic publishing is meant to cover the techniques which make full-text delivery available to a wide audience through the use of on-line systems. This paper exposes the author's own views and do not necessarily represent CBS Inc's position on the issues discussed herein.

INTRODUCTION

The concept of electronic publishing as an alternative to print publishing is well known. It has been the subject of many studies, the most extensive being probably the one conducted at MIT in the mid-1960's.¹ In what was called the INTREX project, an impressive staff of computer and information specialists attempted to define the operational and technical aspects of the transition that large university libraries would have to undergo to adapt to the online creation, storage, and retrieval of information materials, which, until that time would only have been available in a printed form. The MIT study predicted large scale electronic publishing by the mid -1970's. More recently, F.W. Lancaster² estimated that this would not happen before the mid-1990's. While the two estimates differ by a factor of two, and the first one was supported

by extensive basic research, in neither cases was technology deemed a problem to the success of electronic publishing. It is the purpose of this paper to discuss what seems to be a specific obstacle to electronic publishing, the electronic mismatch between authoring/publishing requirements, and retrieval/usage needs, and identify the areas where Records Management can assist in removing it.

INFORMATION AND RECORDS MANAGEMENT

Records can be defined as a physical documentation, or evidence of an activity. As such, they can provide a frozen frame of reference for an existing condition at a given time. However, without a context, and an organization scheme, records cannot be interpreted.

At the same time, information can be defined as any change in one's environment which reduces uncertainty of choice in a decision making process.³ In order for this choice to be made, it is necessary to monitor the environment, and therefore, have access to records of some sort.

Records Management is the discipline which makes needed records available in a timely and accurate manner, without gaps, and with minimum overlap. In order to be effective, Records Management must cover the entire life cycle of the records, and follow the information they contain, independently of the medium used for the records involved.⁴ The use of appropriate classification schemes then allows the correlation of records independently of local storage conditions.

ELECTRONIC PUBLISHING AND THE USER BOTTLENECK

From the user point of view, electronic publishing makes vast amounts of material available, without the aggravations which can be identified in a traditional library/print publishing environment. However, once the user has reached his own intellectual/physical processing capabilities, the benefit of access disappears. In fact, it can be said that, unless it is properly used, the major effect of an electronic publishing system is to saturate the user's processing system faster than with traditional print publishing.

In order to minimize this danger, electronic publishers must make available to the user the tools which will allow to filter materials in such a way that what will be retrieved will remain below the user's limits, without reducing the quality of the retrieval.

One of the latest efforts in this regard is probably the one associated with the development of full-text retrieval systems. Rather than attempting to index materials in a multiple ways to satisfy a wide range of users, users are given the possibility to do free-text searching.⁵ This technique works well when the search terms are explicit, but is difficult to use when implicit concepts are involved. Therefore, far from improving access to only relevant information, electronic publishing raises the danger that, due to the mass of materials readily available, quality of retrieval might decrease.

RECORDS MANAGEMENT IN THE CONTEXT OF ELECTRONIC PUBLISHING

As indicated earlier, the objectives of Records Management are to insure that needed materials are available in a timely and complete fashion. This requires a clear understanding of the user's information needs and constraints.

In order to achieve satisfactory results, the Records Management system must require the identification and formulation of user's requirements, and the specification of trade-offs that the user will be willing to make to optimize retrieval from his point of view. Among the most crucial trade-offs is the balance between time and accuracy/relevance of the retrieval process. If the end user has no time constraints, he can browse through a large amount of documents to identify those that are relevant to his query. If this is not the case, the system must be prepared to deliver highly selective materials. In the first case, the electronic publisher would allocate minimum resources at the front-end indexing, and most of the cost will be borne in terms of browsing time at the user end. In the second, the resources are entirely allocated at the front-end, leaving minimum costs spent at the user side. Of course, the total cost from publisher to user does not change, and the user ends up paying that total cost. However, in the first case that cost will be in currency, while in the second it might be in a combination of currency and time/labor.

The identification and formulation of the user's requirements should be of importance to the electronic publisher, because they provide information well beyond what is needed from a pure marketing standpoint. If they are translated into authors terms, they

allow the establishment of relationships between author's and user's frames of references.

It will then become possible for the electronic publisher to anticipate the mix of resources to be allocated to the various components of the publishing system so that the user needs are best met. In particular, the effort spent on indexing and cross references could be tailored before hand, rather than determined from the reactions of the user base to already marketed products.

Records Management techniques are well suited for the identification of needs. In the first place, they address directly the individual user, establishing in a systematic way the retrieval organization of his information. By contrast, traditional publishing surveys will tend to focus on the marketplace, and therefore try to find the largest reader/user base for a given product. Second, Records Management is highly sensitive to costs, and therefore can provide highly targeted data on the allocation of resources at the user end, thus establishing benchmarks for published products. Finally, Records Management is increasingly making use of on-line retrieval systems, as part of its day-to-day operation. By following the same organization and structure as the one selected for the records retrieval system, the electronic publisher has a better chance to integrate his products into the records management data base of the user.

A PROPOSED STRATEGY

One of the difficulties in integrating electronic publishing and records management at the user level is the fact that there are no standards on either side to follow as far as indexing and

cross-referencing, which would provide the relationship between the publisher and the user.

As a matter of fact, the use of full-text searching, already mentioned widens the gap between author and user, as it will reduce the effort put on indexing electronic publications. A first effort must therefore be the establishment of standard indexing and cross-reference files at the publishing end, to be used for all the publications from that publisher. It is anticipated that through the use of so-called "emphasis indexing"⁶ precision in the selection of terms will not be as important as the consistency of their use. This can be insured through the use of a fully developed thesaurus, cross referenced to the various disciplines which can be interested by the published materials.

Once the end-user is made aware of the existence of a "stable" thesaurus, he will be receptive to the idea of integrating it into his Records Management system, and, in the process, will provide the publisher with the information needed to determine present and future needs, thus establish the relationship mentioned previously. Provided that the electronic publishing system is engineered to monitor patterns of use at the transaction level rather than at the account level, it then will become possible to detect changes, identify trends, and therefore maintain best balance between publisher and user needs. Admittedly, this approach does not take into consideration the practical limitations of the electronic publishing business, but it is

believed, on the basis of past experience in the use of on-line retrieval systems in libraries, that without this standardization between publisher and user vocabulary, both parties are likely to duplicate efforts, creating frustrations and distrust at both ends.

IMPACT OF TECHNOLOGICAL CHANGES

One of the advantages of using Records Management as a guiding discipline is that it is, by nature, medium independent. This should be, for the electronic publisher, a definite asset, as the choice of offering and packaging will become relatively immune to technological changes. In particular, a product which might have been well received under one type of packaging could be tested in an other marketing condition, without requiring significant changes at the user end, as, presumably the user would only require a one-time translation of its information retrieval system to benefit from the new packaging. This possibility is particularly attractive in the Office of the Future/Office Automation environment, where such translation capabilities are readily available for most of the mini/micro computers on the market place, or for use with mass-storage memories.⁷

CONCLUSION

Until recently, Records Management was associated with the handling of paper file, and it was acknowledged that only cost considerations were limiting the application of all the techniques which had been developed in print publishing for the indexing and cataloging of published materials. As a result, records management techniques were not fully developed. Now the situation

is somewhat reversed. With the advent of microcomputers, it becomes possible to apply the traditional techniques of information retrieval to the individual files, down to the individual documents, to meet the need of the individual user. This is the same user that the electronic publishing world tries to reach. It is intriguing to take the challenge.

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- 5 Seldon W. T., and al. "An experiment to study the on-line use of full-text primary journal database"; In: Proceedings of the National ONLINE meeting, 1981, Learned Information; 1981. p. 461.
- 6 D'Alleyrand, M.R. "Emphasis Indexing", The Indexer, vol.11, April 1977.
- 7 D'Alleyrand, M.R. "Holography: A revolutionary alternative for storing information. Words. June-July 1980. p.36.

ABOUT THE AUTHOR

Dr. Marc R. D'Alleyrand is currently Director of Records Management at CBS Inc. Educated both in France and in the United States, his professional background covers a wide spectrum of information systems design and implementation. He holds a Doctorate in Electronic Engineering from the University of Paris and a MLS from Queens College in New York.

The electronic era: implications for consultancies

E s t h e r D y e r

S. B o w k e r

Blue Cross and Blue Shield of Greater New York

New York, New York

U.S.A.

authors were not able to attend the symposium

THE ELECTRONIC ERA:
IMPLICATIONS FOR CONSULTANCIES

by Dr. Esther R. Dyer

Blue Cross and Blue Shield
of Greater New York

and Scott Bowker

Blue Cross and Blue Shield
of Greater New York

A Paper Prepared for the Essen Symposium 1983 "New Trends
in Electronic Publishing and Electronic Libraries".

Everyone has the right to freedom of
opinion and expression; this right
includes freedom to hold opinions...
and to seek, receive and impart infor-
mation and ideas through any media and
regardless of frontiers.

- Article 19
Universal Declaration
of Human Rights

The aftermath of World War II coupled with the
increasing fear of "closed societies" in the Socialist
countries [which, incidentally abstained from voting on
Article 19] prompted the expansion of communications products
from U.S. publishers, broadcasters and press agencies to meet
the market demands: initially of Europe in an economic and
social recovery stage and more recently the growth of
communications products from all developed countries to
satisfy the new markets in developing countries. The overall
picture of the production and use of communications technology

has changed dramatically in the last 40 years. Recently, for example, allegations similar in nature to those opposing "free flow of information" have been launched against the U.S. by such friendly nations as India, Nigeria, Brazil, Canada and France who have questioned the following:

1. the cultural imperialism implicit in U.S. dominance of communications export markets
2. the bias of U.S. news agencies and data bases
3. the threat to national sovereignty implicit in U.S. control of computers, satellite and communications technology (7).

European countries are now even questioning the economic vulnerability of a society based on the merger of computing and telecommunications technologies (3). As early as 1970, it was postulated that Article 19 would remain empty rhetoric until the communications resources and high technology were more evenly distributed through the world (7). At the present moment, it is widely felt that "free flow of information" is unidirectional in nature, flowing from information rich to information poor countries. Clearly in such a situation, the philosophy and interpretation of facts transmitted would be biased and concomitantly the viewpoints and news of lesser developed countries largely ignored (3,7).

The astonishing proliferation of electronic communications in the 1980's, which makes feasible computer, satellite and telecommunications exchanges across borders - transborder data flow (TDF) - further exacerbates the problem

outlined above. This type of communications is indeed not only high technology but also high finance. Leaders in developing countries have demanded greater access to scientific and technical information (STI) since the economic and social well-being of their countries have become increasingly dependent on the efficient compilation of essential information and its timely delivery to policy makers (6).

Yet a paradox exists in that developed countries, primarily the U.S., while insisting on the free flow of news and communications, are now questioning the political and national security implications of free access to STI. A free access policy to such information may well help opposing factions achieve competency and even ascendancy in strategic technologies and garner larger shares of the world economic markets with detrimental results to entrenched industries of developed countries.

Given the situation outlined above, it is interesting to consider what, if any, impact the burgeoning electronic era will have on the role of the international library consultant and his or her contributions to developing information systems in lesser developed countries. Before we can consider this issue, however, it is necessary to define several terms that will be the touchstones for discussion: consultant, electronic era and teleconferencing.

Clearly there are many definitions of the term "consultant". For the purpose of this discussion, the following parameters will outline the "job description" of library consultants:

library consultant may be defined as an individual qualified by education, experience, technical ability, and temperament to advise or assist on a professional basis in identifying, defining and solving specific library problems involving the organization, planning, direction, control and operation of a library (or information agency). The consultant serves ... as an impartial, objective advisor and is not a (regular) employee of the organization (10).

The essential elements of this definition are the professional abilities of the consultant, including technical knowledge and, traditionally, geographic proximity to the source of the problem.

The Electronic Era can be defined as the current and projected state of high technology, such as computers and satellite communications. Many permutations are possible with available hardware to meet global information needs. The Electronic Era is comprised of a variety of alternative communications delivery systems, including: electronic publishing (bypassing paper copy), electronic mail, automated information retrieval systems, telephone, teleconferencing, telefacsimile transmission and telex, to name but a few. With regard to the implications of the Electronic Era on

the role of the international consultant in developing countries, we will focus primarily on the potential impact of teleconferencing on the consulting process.

Teleconferencing consists of a formal exchange of views in order to discuss common concerns through the use of bidirectional communication technologies, e.g. satellites, telefacsimiles, conference telephones, Gemini blackboards and interactive video. Teleconferencing can take one of three forms - audio, which can be supplemented with the use of slides and photographs; video, which allows participants to view their fellow conferencees along with pertinent visual data; and computer, where machines communicate with one another.

Those of us living in information rich societies are indeed at a crossroads in deciding how and to include the "new technologies" into the operational plans of information agencies. The onslaught of sophisticated information systems and their enabling technologies have created even greater problems in developing countries. Developing countries are caught in a technological and financial bind:

... to have an adequate information processing capability, the country (Brazil) must rely on computer resources of foreign countries or import more hardware, both options that drain valuable currency resources. The alternative is to build a national computer industry, but

this also requires resources, especially highly skilled manpower resources that are beyond the capability of all but the most developed nations (12)

Thus, increasingly consultants are asked to propose solutions to technological problems, to bridge the gap, so to speak, between the available and needed human resources for information management. Consultants are employed to recommend hardware, develop software and train information managers, among other tasks.

Consultants tend to be practicing technocrats from high-tech countries who use their professional expertise to advise projects in developing technopeasant societies, where the skills and familiarity with computers, telecommunications and other information technologies vary widely. In Brazil, for example, only a handful of people hold PhDs in library/information science and the access to telecommunications information is economically prohibitive. In other countries, we are looking at the difficulties created by the superimposition of technology on agricultural societies. The growth and development of information services in developing countries is diffuse, uncoordinated and often sporadically funded.

A crucial question facing developing countries is the choice of appropriate technologies. Prior industrial developments have clearly favored capital-intensive methods.

The vast majority of the world's STI is controlled by developed countries and is often transferred to developing countries through multinational corporations. Technological transfer via the multinational conduit has not emphasized the appropriate choice of technologies but rather has selected the most convenient, expedient and cost effective method that is suitable for the company. Developing countries generally lack the infrastructure necessary for choosing appropriate technologies. Such infrastructure would include: technical personnel, an institutional framework, hard currency, sufficient markets, management systems and telecommunications capabilities, etc. "The imbalances created by industrial growth", according to the Director of the Documentation and Publications Division of the Industrial Development Board of Ceylon, Sri Lanka, "have led to the acceptance of the need for the development of appropriate technologies, thus bringing the concept of choice of technologies from the periphery to the centre." (13). In 1980, the developing countries announced an action plan at the third General Conference of the United Nations Industrial Development Organization (UNIDO), that sought to increase their share to 25% of total world industrial production by the year 2000 and called for cooperation among developing countries as well as assistance from developed countries in the promotion of training, transfer of technology, industrial production and development of energy resources (14).

There are a number of developing countries, such as Argentina and Guatemala, which have agencies that deal with selection of appropriate technologies. One of the key advisory services, on a worldwide scale, is that of UNIDO, which has developed the Industrial and Technological Information Bank (INTIB), a project begun in 1977 designed to strengthen and complement the existing information and advisory services of the countries and organizations with regard to development or adaptation of technology for developing countries. The INTIB relies heavily on linkages with distributors, manufacturers and users of STI and its accompanying hardware, seeking to establish two way communications channels through the provision of technology/subject files, anecdotal reactions to products, sources of information and suppliers.

The international scope of UNIDO combined with those of national groups provides another valuable resource for the consultant seeking to suggest solutions to technological problems, to recommend appropriate technologies and sources of information. Yet choice of technologies and the advice given with regard to the development of information technologies is not the only way in which the work of the consultant will be affected by the Electronic Era. The very process of consulting may be dramatically changed by the advent and use of teleconferencing and interactive telecommunications. There

are 14 basic steps in the traditional management model of the consulting process:

1. Acquire environmental knowledge; improve awareness of political/cultural context, etc.
2. Establish understanding of perceived problems.
3. Diagnose actual problem.
4. Feedback to client.
5. Establish understanding.
6. Preliminary goal and position statements.
7. Commitment to project.
8. Resource analysis.
9. Conceptual planning.
10. Plan approval.
11. Master planning.
12. Final commitment.
13. Staged implementation.
14. Evaluation and redirection of plan (5).

Traditionally the management process outlined above takes place in several stages: first the offsite, initial communications which often are sketchy at best; second, the onsite visit or visits with one or at most several consultants; and third, the either offsite or occasionally onsite follow-up activities. The process is often uncomfortable and unweildly for both the consultant and the client. It is not uncommon, in the initial stages, for example, that the problems and ground rules are inadequately explained. Onsite visits are further hampered by lack of access to trained

personnel, materials and interaction with others knowledgeable about specific aspects of the project. The final stages of implementation and evaluation - redirection are often out of the consultant's hands, so to speak. The period of employment is over and the consultant returns home. Occasionally, there is further interaction, another visit, telephone calls, long distance consultation - but generally the employers are left with someone else's idea of how to approach the project (at worse) or a plan of action that is emphatic to local needs but for which additional technical expertise may well be needed, either on a long or short term basis (at best). However, very few projects have tapped the wider network of significant others who have expertise in specific aspects of the project. For example, someone whose speciality is records management, or development of serials data bases or audiovisual training methods.

Yet the achievement of goals, the implementation of plans and the flow-through and re-direction of efforts for projects employing consultants can be greatly enhanced through the judicious use of telecommunications. Many of the inherent problems in the consulting process can be alleviated or eliminated. The clients can have greater access to a wider variety of experts without the traditional accompanying financial and time burdens of temporary consulting assignments. Further it is entirely possible to have consultants affiliated with long range projects on a need to use basis.

The major stages of the consulting process are diagrammed below in Figure 1. The specific steps are superimposed on this in Figure 2, roughly corresponding to those outlined in the 14 stage management model previously cited. It is in Figure 3, however, that the potential benefits of the availability and applications of telecommunications to the consulting process is elaborated. Clearly the potential of enhanced communications, faster and more efficient

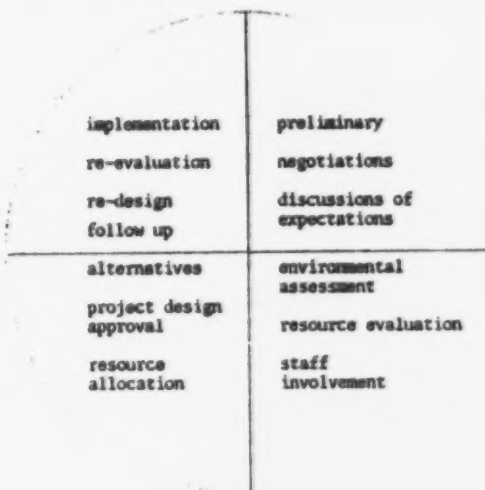


Figure 1.

and minus the typical "noise" of traditional paper and pencil interaction as well as an expanded range of access to expertise is possible.

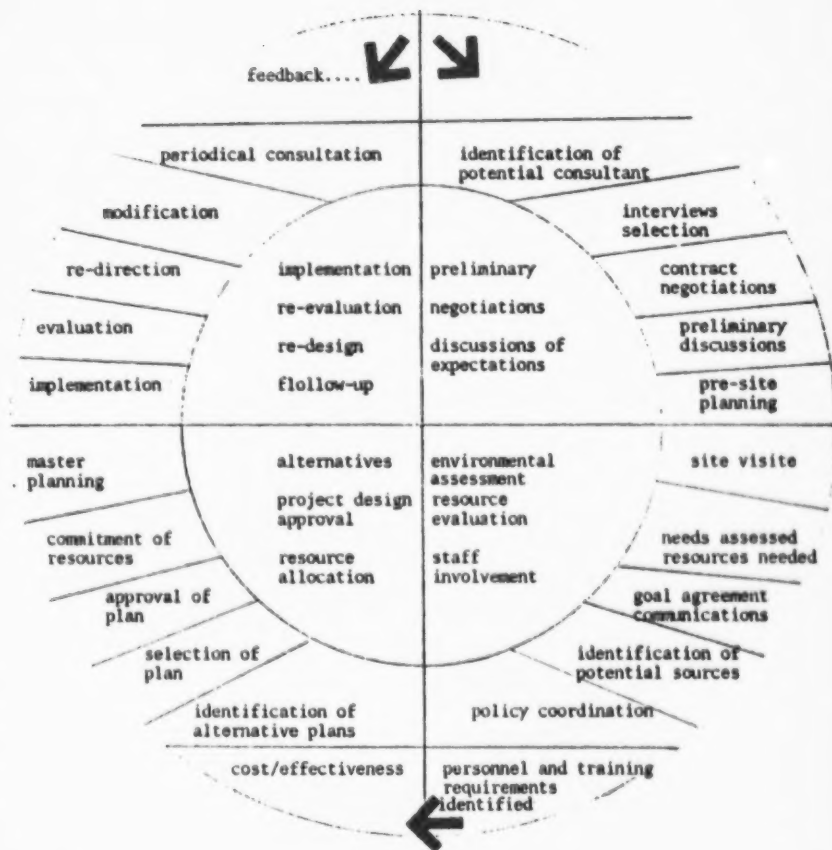


Figure 2.

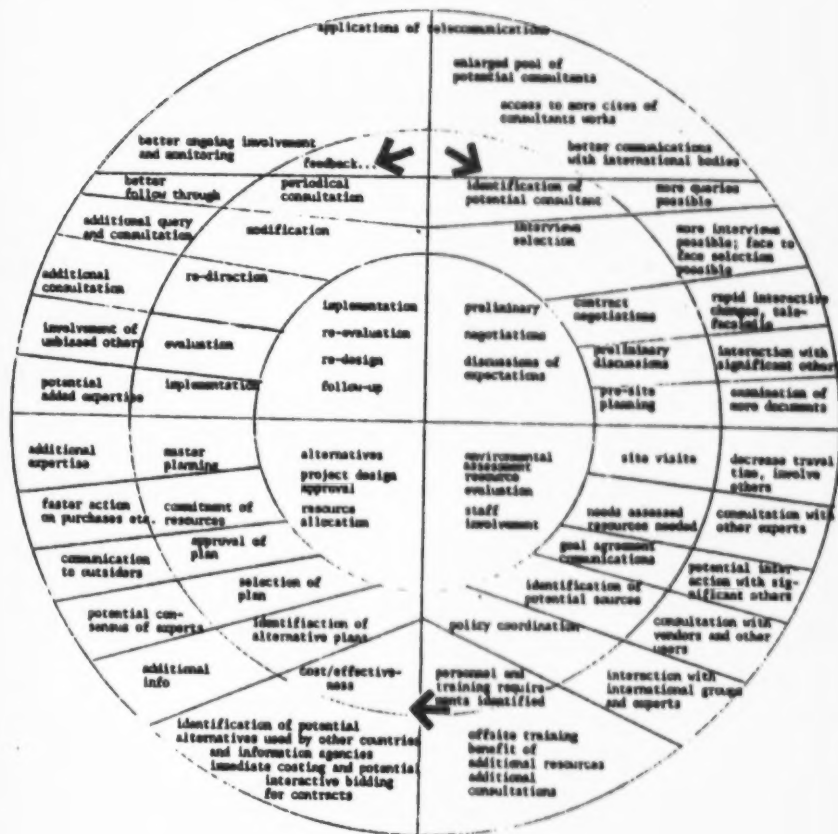


Figure 3.

To summarize the advantages of the use of telecommunications technology in the consulting process clear; availability of a wider range of information and resources (both documentary and human resources); increased potential of interaction with significant others with a wider range of expertise; instant document delivery; faster costing and communications with sources and suppliers as well as the potential for longer range involvement of selected consultants in projects. The day may soon be coming when it is feasible for countries and information agencies to have on a retainer basis the services of numerous consultants at both a lesser cost and with faster turn-around time for queries than at present - to tap in, so to speak to the wide network of "significant others".

Teleconferencing has proven to be extremely effective in the developed world. In 1982 alone, \$55 million was spent in the U.S. on teleconferencing: 60% for audio, 30% for video and 10% for computer-conferencing. Richard Adler, of the Institute of the Future, predicts that by the year 1990, more than \$850 million will be spent on teleconferencing in the U.S. (1).

Librarians and information specialists are fond of the terms "Information Age" and Information Explosion". The current thinking postulates that the information profession is at the crossroads in successfully adapting the new technologies as well as using them to best advantage. Yet, surprisingly,

It is the private sector that is currently in the forefront of developing economically feasible highspeed telecommunications, such as telefacsimile and teleconferencing. It is an interesting phenomena of free enterprise that the international hotel chains are pioneers in teleconferencing. Hotels with their worldwide locations and satellite connections for cable television as well as a developed relationship with government agencies within host countries have unique advantages.

The Video Network operated by Holiday Inns for the continental U.S. could be used as a model delivery system. In its fourth year of operation, Holiday Inn has established 258 teleconferencing locations in the U.S. The geographic dispersal of the network allows for the inclusion of many locations and more people than could easily and economically be organized in a traditional conference. In a series of parallel developments, the Marriott, Hilton and Sheraton Hotels offer similar systems, albeit on much smaller scales. Intercontinental Hotels currently provides teleconferencing links between New York and London and will be expanding service to Paris, Frankfurt, Sydney and other international political and business centers (8). Clearly in the near future, there may be easy access to teleconferencing on a contract and need to use basis in many of the world's major cities.

In addition to the major hotel chains, the other potential access point for countries and consultants, until the

state-of-the-art and the economics of telecommunications are within reach, are the multinationals in host countries. A system frequently used by multinationals is that created by AT&T Information Systems, a recently created subsidiary of the American Telephone and Telegraph Co. AT&T is developing revolutionary forms of teleconferencing, which coupled with its unique worldwide ability to carry information via satellite and telephone circuits open the advantages of teleconferencing to a wide diversity of organizations.

Teleconferencing should enhance, rather than replace, the one-to-one interaction of consultant and client. Researchers at Johns Hopkins University conducted an extensive review of the literature on teleconferencing and found that the most effective uses of teleconferencing were in the following areas:

1. giving or receiving information
2. asking questions
3. exchanging opinions
4. problem solving
5. generating ideas.

Not surprisingly, the researchers found that teleconferencing was not as effective as face-to-face communications when sensitive bargaining or initial "getting-to-know-someone" situations were primary goals of the conference. Among the most effective uses of teleconferencing, therefore, were the following: talks by management or special speakers; guidance; coordination of meetings, production or scheduling; training

lecture, classes; briefings; idea exchanges; expert consultation; on-going communications and crisis intervention (2).

The use of any of the telecommunications networks and systems would free the consultant and the client from many of the barriers inherent in cross cultural communications, including the international mails. The lengthy delays in international postal delivery and the potential for misinterpretation of a letter's content, exacerbated by communications in non-native languages, are minimized when the potential for interactive responses are introduced.

The advantages to teleconferencing are numerous: increased productivity and decreased costs both in terms of time as well as money. Through the use of teleconferencing, for example, the consultant can maintain contact with his or her project, acting as an international advisor without the need to be present physically. Since consulting projects are often re-evaluated, re-defined and changed based on operational as well as political expediencies, teleconferencing can provide a vital and on-going link that enhances the speedy resolution of crisis situations and adaptation of existing plans.

The current economic feasibility of telefacsimile, yet another alternative in the telecommunications arsenal, can be used alone or in conjunction with teleconferencing to provide for the virtually instantaneous transmission of vital information, documents and commentary to both consultants

have placed extremely high tariffs on telecommunications and computerized information systems. These tariffs, intended to stimulate the growth of domestic telecommunications and computer industries, have resulted in stemming the tide of transborder data flow. As a Brazilian policy maker so aptly states:

Among the best known examples of transborder data flow, from the economics point of view, are: technology transfers, import and export of computer programs, interactive databases, consultation, data flow and real time operational or administrative control of companies, teleprocessing of data and digital data communications.

In the future informatics societies such resources will tend to constitute a basic indicator of economic power and of national identity. Lack of such resources can generate the same dependence as the one we experience today with oil supply. Thus, all official activities must be directed at maximizing Brazilian information resources. Therefore, TDF is and will continue to be submitted to 'political values' that subordinate it to these objectives (3).

The Brazilian situation is indicative of the problems faced by developing countries caught in the bind between a critical need for access to information and the political and national realities of creating their own information sector, with the accompanying infrastructure.

The superimposition of telecommunications on the entrenched consulting process regarding the development of information systems and services is still in the embryonic stages. Clearly the exponential growth of these technologies

will have a tremendous effect on the future of the information sector throughout the world. The quintessential question, however, remains whether or not the technologies of the Electronic Era, used judiciously by consultants and their clients can successfully overcome the political, economic and social problems inherent in the consulting process. It remains to be seen if the political realities of TDF and the economics of telecommunications technology can be transmuted to effect a fruitful grafting of the paraphernalia of the Electronic Era to the stock of the consulting process.

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